Reversed Field Pinch Research in MST

Final Technical Report

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1 Overview of the MST Program

This is the Final Technical Report for the cooperative agreement DE-FC02-05ER54814 titled "Reversed Field Pinch Research in MST" spanning the funding period 4/1/2005 to 12/14/2019. It summarizes key results from MST research, major publications and presentations, and the mentoring of graduate students and postdocs. The Madison Symmetric Torus (MST) is unique within the U.S. and world fusion plasma program. As one of just five operating reversed field pinch (RFP) experiments, and the only one in the U.S., MST has had an important role in advancing the fundamental understanding of the RFP plasma configuration. Three synergistic research mission goals have guided the MST program, as visualized in Fig. 1:

- *Advance the physics and control of the RFP plasma configuration*
- *Advance the predictive capability of fusion science*
- *Discover basic plasma science and its links to astrophysics*

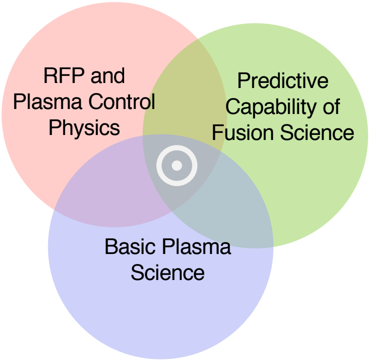

Figure 1: MST research mission goals

The MST research program targets topics that intersect with all three goals. While MST provides a unique opportunity to advance the science and fusion potential of the RFP, as a cousin to the tokamak and stellarator plasma configurations the RFP is a valuable partner in establishing validated predictive capability for fusion science more generally. Specific combinations of the major variables in toroidal confinement, like magnetic field strength, plasma current, and shaping, define the different configurations. By exploring adjacent regions in this major variable parameter space, the RFP exposes dependencies not otherwise accessible in the tokamak and stellarator. This diversity enlarges the arena for scientific discovery, both for fusion and plasma physics. The basic science emphasis for MST research has been the self-organizing behavior of RFP plasmas. This inspired MST's participation in the NSF Physics Frontier Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas (CMSO), which ran from 2004-2016 and motivated a substantial fraction of MST's research goals and capabilities.

By all measures the MST Program has been remarkably successful in publications, community engagement, and mentoring of young scientists. While the DOE-FES's proof-of-principle program for the RFP now languishes through the cessation of this cooperative agreement, operation of MST continues as one of two devices included in the new Wisconsin Plasma Physics Laboratory (WiPPL) basic science user facility. The scope of present research for MST in WiPPL is narrowed to the basic science associated with the RFP magnetic configuration and the advancement of specific fusion topics, which now includes studies of disruptions in tokamak plasmas. The world's effort in RFP fusion research continues, despite a lack of U.S. federal support to investigate the RFP configuration for fusion application, most notably through a major upgrade to the RFX-mod2 facility in Italy [1] and the recent construction of the KTX facility at USTC in China. First plasmas for RFX-mod2 are anticipated in 2021.

1.1 Advance the Physics and Control of the RFP Plasma Configuration

The RFP configuration offers significant potential benefits in closing the gaps to fusion power, stemming from the greater concentration of the magnetic field within the plasma. Almost all of the magnetic field confining the plasma is created by current within the plasma. Two main benefits arise: (1) the possibility for ohmic heating to ignition using efficient inductive current sustainment and (2) minimization of the field strength at the surface of magnets. There are only three ways to heat a toroidal, magnetically-confined plasma to burning plasma conditions: (1) neutral beam injection (NBI), (2) intense rf waves that resonate with charged particle motion, and (3) ohmic dissipation of plasma current. While present-day fusion experiments employ neutral beam injection, the 1-2 MeV neutral energy required for a large, dense fusion plasma plus unavoidable large holes in the wall and blanket make NBI extremely challenging in a reactor. Instead, most tokamak-based reactor studies anticipate heating and control using rf, likely a combination of cyclotron heating and lower-hybrid current drive. The rf antennas must be located close to the plasma for efficient coupling of ion cyclotron and lower hybrid waves, but the antenna boundary conditions are very different than for the majority of the plasma-material surface which must accommodate intense heat, particle, and neutron fluxes. If the antennas do not operate with high reliability and low maintenance, an energy source with high availability is not possible. Robust rf heating and control is a critical gap for fusion development.

In the fusion energy context, studying the RFP configuration is synonymous with assessing and developing the possibility for ohmic ignition in a toroidal reactor. The RFP has large plasma current and small toroidal field, with $q(r) < 1$. Its relatively large current density makes ohmic ignition and high fusion gain possible without auxiliary heating, if energy confinement is similar to a same-size tokamak [2] . Hence the first-wall may be covered entirely by suitable fusion-relevant materials. Minimization of the field at magnets arises naturally for the RFP because the poloidal magnetic field is dominant, and $|\mathbf{B}|$ *decreases* from the plasma surface toward the magnets to a level that could be supported by normal conductors. The engineering beta, i.e., plasma pressure normalized to the peak magnetic pressure at the magnet, is $\sim$10X greater in the RFP than for a tokamak with the same volume-averaged beta, $\langle\beta\rangle = \langle p\rangle/\langle B^2/2\mu_0\rangle$. Since a practical fusion energy system must be maintainable and reliable to assure high availability of power production, ohmic heating and simpler magnets could be enormous leverage in achieving these requirements.

1.2 Advance the Predictive Capability of Fusion Science

Arguably the highest priority challenge for fusion energy is convincing the world its science foundations are predictive, so that successive development steps are trustworthy. This challenge is recognized as one of the strategic goals of the U.S. fusion energy sciences program: *"Advance the fundamental science of magnetically confined plasmas to develop the predictive capability needed for a sustainable fusion energy source"*.[1] A suite of well-diagnosed experiments is essential to achieve this goal. By definition, "predictive" implies an understanding of the plasma's behavior when changing key variables. The various named configurations (tokamak, stellarator, RFP, etc.) are really one grand experiment in which the fundamental variables that govern magnetic confinement are set differently, because it is impractical to do this in a single laboratory setting. Predictive fusion science should embrace multiple configurations as close cousins, not just view them as competitors for fusion. Importantly, the base plasma models are the same for all configurations so that the inevitable physics and technological tradeoffs can be understood, even allowing the possibility for optimized configurations yet to be discovered. MST research has emphasized physics topics and research methodologies aimed specifically to advance the predictive capability of fusion science. Methods of rigorous verification and validation (V&V) that have been advocated for fusion research, e.g., ReNeW[2] Thrust 6 "Develop predictive models for fusion plasmas, supported by theory and challenged with experimental measurement." More recently, the report "Workshop on Integrated Modeling"[3] also emphasized the growing importance of broadly-based verification and validation, concluding in its Executive Summary that *"broad-based community support for model verification and validation is essential in order to realize the goals set forth in this report."* The MST is well-suited to contribute to this challenge: its well-diagnosed

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[1] From the DOE FES homepage http://science.osti.gov/fes/

[2] "Magnetic Fusion Energy Sciences ReNeW Workshop Report,", http://science.osti.gov/fes/community-resources/workshop-reports (June 8-12, 2009).

[3] "Report of the Workshop on Integrated Simulations for Magnetic Fusion Energy Sciences," http:// science.osti.gov/fes/community-resources/workshop-reports (June 2-4, 2015).

plasmas, range of accessible parameters, and rich physics base make it ideal for a strong focus on validation. The primarily focus for validation studies has been visco-resistive MHD. Nonlinear MHD theory and codes (NIMROD and DEBS) are well established in RFP research due to the dominance of tearing instability in the magnetic self-organization process. The theory and codes are presently being extended to include two-fluid effects, necessary for understanding coupled electron and ion momentum dynamics.

1.3 Discover Basic Plasma Science and its Links to Astrophysics

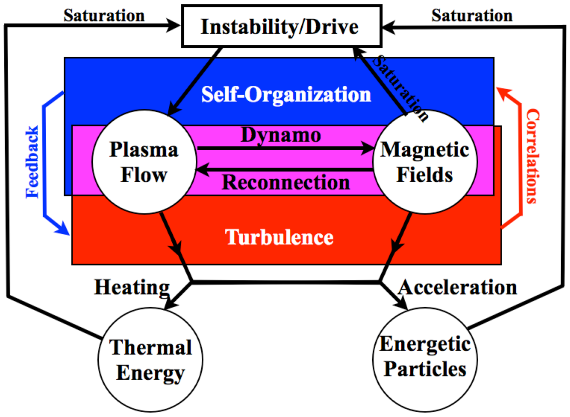

Figure 2: Connections between the different components that drive the energetics of the plasma universe.

The RFP plasma inspired, in large part, the concept of magnetic self-organization in laboratory and astrophysical plasmas. The seminal work of J.B. Taylor established a basic relaxation theory that explained how a reversed toroidal field can be created and maintained. The magnetic flux conversion process involved in relaxation dynamics gave rise to the concept of the RFP dynamo, closely related to astrophysical dynamos that convert mechanical energy into magnetic energy. This self-organizing behavior helped inspire the CMSO Frontier Science Center funded by NSF.

While Taylor's theory of the minimum-energy relaxed state provides remarkable insight, the full challenge of understanding the dynamics and interrelationship of diverse self-organization phenomenology, including magnetic reconnection, turbulence, dynamo, and particle energization has come to light only in the last ten years. The set of self-organizing behaviors found in MST plasmas is well-aligned with Chapter 4 *"Understanding the energetics of the plasma universe"* in the recent "Report of the Panel on Frontiers of Plasma Science"[4]. The overarching question for this discovery science frontier as stated in this report is: *"What processes control the transformation of energy between forms, the transfer of energy across vast differences in scale, and the transport of plasma energy in the Universe?"* The report uses the diagram shown in Fig. 2 to illustrate the key processes and interconnections that are involved in plasma energetics: (1) Energy Transformation: Flow to magnetic field (dynamo); (2) Energy transformation: Magnetic field to flow (reconnection); (3) Acceleration of high energy particles in plasma; (4) Turbulent cascade and dissipation; (5) Self-organization: Generation of coherent structures from turbulent flow; (6) Transport of plasma particles, momentum, and energy through space.

Remarkably, MST plasmas exhibit almost all of these processes and interconnections simultaneously. Tearing magnetic reconnection is the driving instability, which saturates through a nonlinear two-fluid relaxation process that creates the RFP dynamo as well as parallel flow through the fluctuation-induced Reynolds stress that is essentially identical to the Hall dynamo emf, $\langle \widetilde{\mathbf{J}} \times \widetilde{\mathbf{B}} \rangle_{||} / e n_e$.

Few laboratory plasmas exhibit the scope and strength of ion heating and energetic ion tail formation seen in MST, a particularly important process in astrophysical plasmas. The suite of ion diagnostics available on MST is able to measure both majority and minority species temperatures, isolate anisotropic heating relative to the mean magnetic field, and resolve the spontaneously generated energetic ion tail distribution.

A turbulent cascade is observed in both magnetic and kinetic energy of MST plasmas, with recently discovered signatures that hint drift waves become an energetic component at small scales. Modeling the turbulent cascade from large-scale tearing to small-scale microturbulence represents a computational grand

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[4] "Report of the Panel on Frontiers of Plasma Science," http://science.osti.gov/fes/community-resources/workshop-reports (May, 2016)

challenge which is presently beyond the reach of either fluid-based models or kinetic models based on gyrokinetic or particle-in-cell approaches.

2 The MST Facility

The MST was designed and highly optimized to be a world-leading RFP experiment [3]. It and RFX-mod in Italy are the world's most capable RFP facilities. The MST produces fusion-grade, high-temperature plasmas with energy confinement times comparable to a same-size, same-field tokamak. The MST also produces low-field tokamak plasmas. The plasmas produced in MST are ideal for frontier plasma science investigations of magnetic reconnection, turbulence, particle energization, dynamo and coherent structure formation. The MST facility gives users access to a well-characterized toroidal plasma with a comprehensive suite of diagnostics.

The construction of MST is unique in having an aluminum shell that serves as both the vacuum vessel and the equilibrium magnet, illustrated in Fig. 3. The plasma's minor and major plasma radii are $a = 0.5$ m and $R = 1.5$ m respectively. The aluminum shell's minor radius is $a = 0.52$ m, and graphite protectors mounted on the inside surface limit plasma contact with the shell. The poloidal field is created by inductively driven plasma current that can be adjusted over a wide range 30-500 kA. Ohmic heating up to 10 MW is provided by the dissipation of the plasma current. An externally applied toroidal field of up to 0.25 T is produced by one-turn current in the aluminum shell. Recent and ongoing development of high-bandwidth, high-current switching power supplies provide waveform control of the plasma current and toroidal field. The plasma density ranges 0.5-1.5$\times 10^{19}$ m^{-3} with electron and ion temperatures between 50-2,000 eV depending on discharge type. Discharges are typically 30-60 ms long, and over 100 shots are collected during a run day.

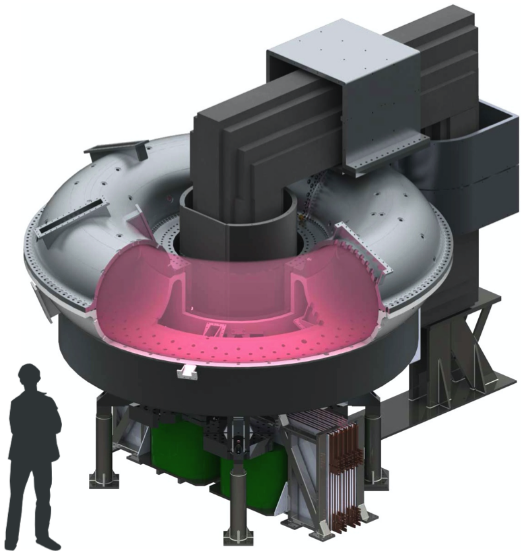


Figure 3: The MST device. The primary components are an aluminum vessel and large iron transformer. A small iron transformer underneath the vessel (painted green) couples the shell as a single-turn toroidal field winding.

The development of advanced plasma diagnostics has been a pillar of MST research. Several of MST's diagnostics are now duplicated on other facilities. Major MST diagnostics include high rep-rate Thomson scattering, FIR interferometer-polarimeter, charge exchange recombination spectroscopy, motional Stark effect, multi-energy soft x-ray cameras, soft x-ray tomography, fast x-ray detectors, neutron detectors, advanced neutral particle analyzers, and a heavy ion beam probe. See https://wippl.wisc.edu/madison-symmetric-torus/ for short descriptions of these diagnostics.

3 MST Collaborations

Collaborations have been essential for the RFP proof-of-principle program. In most years, there were more than 60 scientists involved in MST research, including 7 international. The primary collaborators are listed below. Both UCLA and Xantho Technologies had on-site scientists living in Madison for the period covered by the cooperative agreement.

MST collaborators:

UCLA: Advanced interferometry, Faraday rotation, studies of confinement and magnetic self-organization
Xantho Technologies, LLC: Heavy Ion Beam Probe, studies of electrostatic turbulence & transport
Wheaton College: Advanced spectroscopic diagnostics, studies of magnetic self-organization
Los Alamos National Laboratory: RFP theory
Oak Ridge National Laboratory: RFP theory, modeling, and 3D equilibrium reconstruction
Consorzio RFX, Padua, Italy: Joint RFP experiments, SXR tomography
Royal Institute of Technology, Stockholm, Sweden: Joint RFP experiments
Kyoto Institute of Technology, Japan: Joint RFP experiments, Thomson scattering
University of Science & Technology, Hefei, China: New KTX facility, joint RFP experiments
Budker Institute, Novosibirsk, Russia: Neutral-beam-based diagnostics and heating
Florida A&M University: Neutral particle analyzer, magnetic turbulence
Pierce College: Integrated data analysis
Auburn University: V3FIT 3D equilibrium reconstruction
TriAlpha Energy: Energetic ion physics and fusion product detection
University of Strathclyde, Scotland: Atomic modeling, ADAS
MAST, JET, DIII-D, and ADAS: Atomic modeling of the Stark spectrum for MSE applications
CompX Corporation: Fokker-Planck modeling of RF heating and fast electron diffusion
The Ohio State University: Fast Thomson scattering
General Atomics: Thomson scattering, plasma control system
National Institute for Fusion Science, Japan: Fast Thomson scattering
Princeton Plasma Physics Laboratory: Thomson scattering; Links to astrophysics
University of Chicago: Links to astrophysics
Swarthmore College: Links to astrophysics

Collaborations between MST and the other RFP programs in the world are facilitated by an International Energy Agency (IEA) Implementing Agreement for a "*Programme of Research and Development on Reversed Field Pinches*", which was just renewed by IEA for 2020-2025. Joint-RFP collaborations have not been highly structured, rather arising naturally to take advantage of common interests and goals, leveraging the different capabilities available with the different programs. The MST program also benefits from bilateral arrangements. These have been especially beneficial to facilitate student participation on MST. A formal agreement with the Kyoto Institute of Technology supports bilateral student exchanges.

4 Student and Postdoc Mentoring

The MST facility provides a state-of-the-art environment for training graduate students and postdocs, creating opportunities to work with advanced plasma diagnostics and sophisticated computational tools for important scientific questions in fusion and plasma science. MST students and postdocs enjoy an unparalleled hands-on research experience. They organize and lead experimental campaigns. They operate, helped design, and maintain the diagnostics and auxiliary systems, providing run-time and post-run support. They serve as MST operators in a scheduled rotation and help maintain the facility.

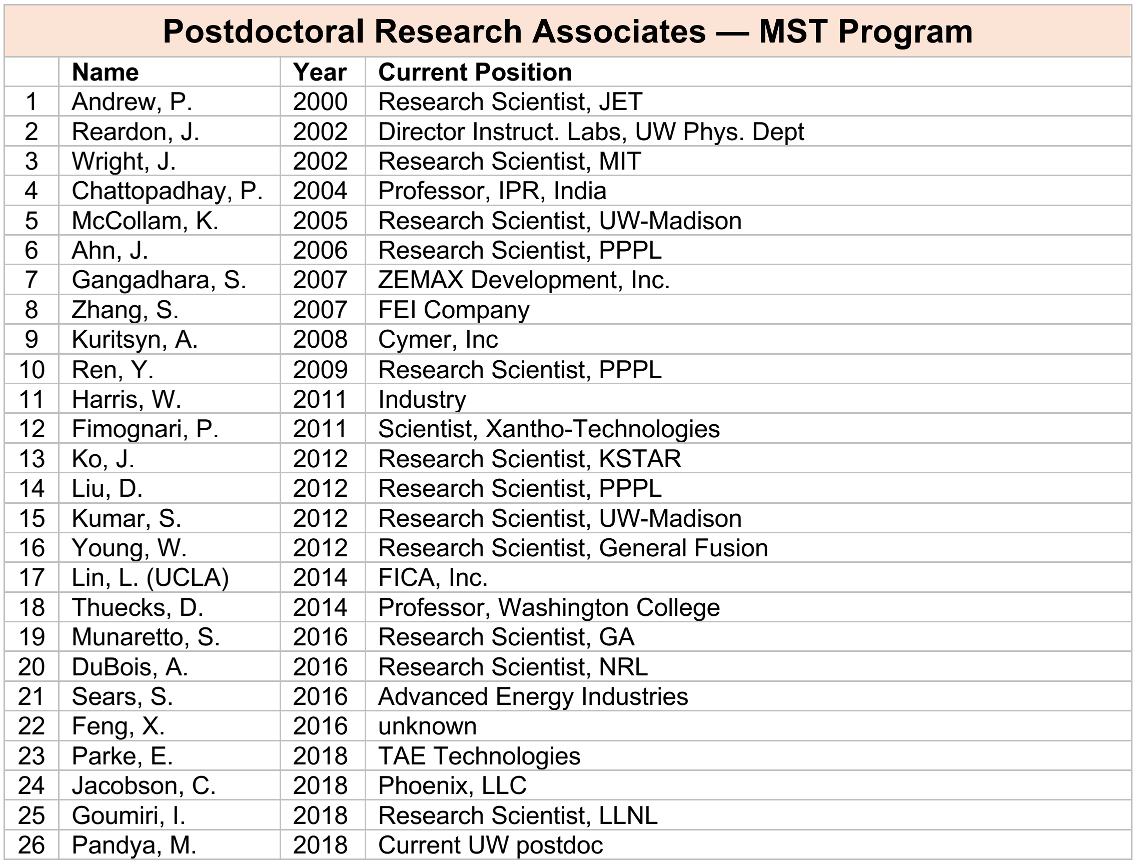
A total of 66 Ph.D. and MS degrees have been awarded for research in the MST Program, listed in Fig. 4. In addition, 26 postdoctoral Research Associates have been mentored through projects conducted on MST, listed in Fig. 5. The majority (60-70%) of these students and postdocs continued in plasma research in all sectors of employment, and nearly all are either professional research scientists or involved in higher education. Twelve former MST students and postdocs are professors at a university or college.

Undergraduate students have also played a critical role in MST research, most employed as student hourlies to help support their education. A conservative estimate is that over 200 undergraduates worked in the MST group. Roughly one dozen senior undergraduate honors theses have been mentored.

Graduate Students — MST Program

	Name	**Year**	**Current Position**
1	Den Hartog, D.	1989	Distinguished Scientist, Research Professor, UW-Madison
2	Sidikman, K.	1990 (theory)	CUNA
3	Beckstead, J.	1990	ChemImage Corporation
4	Almagri, A.	1990	Research Scientist, UW-Madison
5	Chartas, G.	1991	Professor, College of Charleston
6	Scime, E.	1992	Professor, Acting Dean, West Virginia University
7	Shen, W.	1992	unknown
8	Spragins, C.	1992	Business owner, KS
9	Assadi, S.	1992	U Texas
10	Zita, L.	1993 (theory)	Professor, Evergreen College
11	Watts, C.	1993	Research Scientist, ITER
12	Stoneking, M.	1994	Professor, Lawrence College
13	Sovinec, Carl	1995 (theory)	Professor, UW-Madison
14	Chapman, B.	1997	Research Scientist, UW-Madison
15	Chapman, J.	1998	Siemens Corporation
16	Craig, D.	1998	Professor, Wheaton College
17	Fontana, P.	1999	Professor, Seattle University
18	Lanier, N.	1999	Research Scientist, LANL
19	Hansen, A.	2000	unknown
20	Chiang, C-S.	2000	unknown
21	Anderson, J.	2001	Research Scientist, UW-Madison
22	Crocker N.	2001	Research Scientist, UCLA
23	Shah, U. (RPI)	2001 (RPI)	Intel Corporation
24	Biewer, T.	2002	Research Scientist, ORNL
25	Lei, J. (RPI)	2002 (RPI)	Applied Materials, Inc.
26	Ebrahimi, F.	2003 (theory)	Research Scientist, Princeton University (PPPL)
27	Terry, S. (UCLA)	2004	Medical Physicist, Alabama
28	Ling, C. (RPI)	2005 (MS)	Emerson Network Power
29	Blair, A.	2006	Engineer, Raytheon
30	Cengher, M.	2006	Research Scientist, General Atomics, DIII-D
31	Choi, S-H.	2006	Teaching
32	Hudson, B.	2006	Patent Agent, Pillsbury Winthrop Shaw Pittman LLP
33	Zhang, X. (RPI)	2006 (RPI)	GE Shanghai
34	Wyman, M.	2007	Argonne National Laboratory
35	Ennis, D.	2008	Professor, Auburn University
36	Falkowski, A.	2009 (MS)	Phoenix, LLC
37	Kaufman, M.	2009	Research Scientist, ORNL
38	Yates, T. (UCLA)	2009 (UCLA)	Nuclear fission industry
39	Burke, D.	2010	Research Scientist, MIT Lincoln Labs
40	Clayton, D.	2010	Principal Scientist, Mission Support & Test Services
41	Stephens, H.	2010	Professor, Pierce College
42	Tharp, T.	2010	Professor, Marquette University
43	ArchMiller, M.	2011	Professor, Concordia College
44	Yang, Y.	2011 (MS)	Medical physics
45	Magee, R.	2011	Research Scientist, TAE Technologies
46	Reusch, J.	2011	Research Scientist, UW-Madison
47	Chen, X. (RPI)	2011 (RPI)	Research Scientist, GA, DIII-D
48	McGarry, M.	2013	Research Scientist, LLNL
49	Waksman, J.	2013	Program manager, Office of Secretary of Defense
50	Koliner, J.	2013	Lead Data Scientist, APEX Analytics
51	Stone, D.	2013	Engineer, GE Healthcare
52	Parke, E.	2014	Research Scientist, TAE Technologies
53	Caspary, K.	2014	Research Scientist, PPPL
54	Eilerman, S.	2014	Research Scientist, NOAA
55	Morton, L.	2016	Research Scientist, TAE Technologies
56	Capecchi, W.	2017	Donaldson Filtration, Minneapolis MN
57	Triana, J.	2017	EPIC Systems
58	Seltzman, A.	2017	Postdoc, MIT on DIII-D
59	Duff, J.	2018	Research Scientist, Lockheed-Martin
60	Nishizawa, T.	2018	Postdoc, IPP
61	Bonofiglo, P.	2019	Postdoc, PPPL (JET)
62	Xing, A.	2019	Postdoc, GA
63	Boguski, J.	2019	Postdoc, LANL
64	Norval, R.	2019	Intel Corporation
65	Kubala, S.	2020 est	Current student
66	Vanmeter, P.	2020 est	Current student

Figure 4: List of MST graduate students mentored.



Postdoctoral Research Associates — MST Program

	Name	Year	Current Position
1	Andrew, P.	2000	Research Scientist, JET
2	Reardon, J.	2002	Director Instruct. Labs, UW Phys. Dept
3	Wright, J.	2002	Research Scientist, MIT
4	Chattopadhay, P.	2004	Professor, IPR, India
5	McCollam, K.	2005	Research Scientist, UW-Madison
6	Ahn, J.	2006	Research Scientist, PPPL
7	Gangadhara, S.	2007	ZEMAX Development, Inc.
8	Zhang, S.	2007	FEI Company
9	Kuritsyn, A.	2008	Cymer, Inc
10	Ren, Y.	2009	Research Scientist, PPPL
11	Harris, W.	2011	Industry
12	Fimognari, P.	2011	Scientist, Xantho-Technologies
13	Ko, J.	2012	Research Scientist, KSTAR
14	Liu, D.	2012	Research Scientist, PPPL
15	Kumar, S.	2012	Research Scientist, UW-Madison
16	Young, W.	2012	Research Scientist, General Fusion
17	Lin, L. (UCLA)	2014	FICA, Inc.
18	Thuecks, D.	2014	Professor, Washington College
19	Munaretto, S.	2016	Research Scientist, GA
20	DuBois, A.	2016	Research Scientist, NRL
21	Sears, S.	2016	Advanced Energy Industries
22	Feng, X.	2016	unknown
23	Parke, E.	2018	TAE Technologies
24	Jacobson, C.	2018	Phoenix, LLC
25	Goumiri, I.	2018	Research Scientist, LLNL
26	Pandya, M.	2018	Current UW postdoc

Figure 5: List of MST postdocs mentored.

5 Research Accomplishments

The results of MST research from 2005-2019 are reported in 257 publications in major refereed journals and conference proceedings, including 21 *Physical Review Letters*. There are a total of 44 *Physical Review Letters* published to date based on MST research, reflecting the remarkable consistency and sustained scientific productivity of the MST research program. The results from MST research since 2005 have also been presented in at least 343 talks at seminars, conferences, and workshops.

Comprehensive lists of the publications and talks that are related to MST research over the period of the cooperative agreement (2005-2019) are reported in **Appendix A**. Below are summary descriptions of the MST Program's major research accomplishments. The publications listed in Appendix A that are closely related to these research accomplishments are internally hyperlinked and referenced using prefix "A". A wide range of research topics are summarized: energy and particle confinement, density and beta operational limits, stochastic transport processes, energetic ion confinement and stability, 3D self-organization and control, nonlinear MHD self-organization, turbulence, particle energization. The MST program has a strong history of novel diagnostic developments that have been crucial to the success of the research program. Many of these diagnostics have been replicated on other fusion and plasma experiments, including ITER.

Record RFP energy confinement attained at high temperature in MST plasmas: The development of inductive current profile control on MST led to a dramatic ten-fold improvement in the energy confinement of RFP plasmas, to values comparable to that expected for a tokamak plasma of the same size, heating power, and magnetic field strength [4]. The record value for RFP energy confinement time is $\tau_E = 12$ ms, and the electron heat diffusivity attains a minimum value ~ 2 m^2/s in a strong temperature gradient region at $r/a \sim 0.7$. This performance is achieved with a magnetic field strength of only $B(a) = 0.2$ T at the plasma surface, which is still a factor of 20 smaller than for an RFP reactor plasma. By extending inductive current profile control near MST's maximum current (0.5 MA), record high temperatures for the RFP have been obtained. The electron temperature reaches $T_e(0) \sim 2$ keV at a plasma density of 10^{19} m^{-3}. A simultaneous high ion temperature $T_i(0) \sim 1.3$ keV is obtained by optimizing non-collisonal ion heating timed just before indutive control programming is applied. Time-resolved equilibrium reconstructions using the toroidal equilibrium solver MSTFIT [5] show that the sustainment of the plasma current using inductive control is dynamo-free, consistent with improved tearing stability of the current profile and reduced magnetic stochasticity. Combined with results summarized below, good confinement of both thermal and energetic particles is now established for RFP plasmas. [A6,A71,A78,A82]

Plasma pressure exceeds theoretical stability limits in high β improved confinement plasmas: Using frozen-gas pellet injection to reach higher density, the demonstrated beta value for RFP plasmas has been increased to $\beta_{tot} = 26\%$ while maintaining improved confinement. The gradient in the plasma pressure profile exceeds the theoretical limits set by interchange (Mercier limit) and pressure-driven tearing stability. No disruptive behavior is observed past these limits, although the confinement enhancement is smaller, five- to seven-fold relative to standard RFP performance. The achieved beta matches the value assumed for the TITAN RFP reactor system study [6] completed in the early 1990's [A45,A71,A75]

Density exceeds the Greenwald limit in improved-confinement PPCD plasmas: Empirically, RFP plasmas tend to obey the same density limit that is observed in tokamak plasmas, $n < n_G \sim I_p/\pi a^2$ [7]. Stable PPCD plasmas with $n/n_G > 1$ have been obtained using frozen deuterium pellet fueling, enabled by an upgrade to MST's pellet injector. MST's highest density $n = 0.9{\times}10^{20}$ m^3 ($n/n_G = 1.4$) has been achieved for $I_p = 0.5$ MA. Core-localized pellet ablation is aided with high-power, concentrated neutral beam injection (NBI), which induces a rocketing effect that steers the pellet toroidally. The achievement of improved confinement at high density bolsters the advantage for high β in the RFP, with a new record $\beta = 28\%$ in plasmas with NBI. Nonlinear extended MHD modeling using NIMROD shows that pressure-driven tearing is increasingly important at high beta. [A106,A100]

Emergence of microturbulence in RFP plasmas: The energy confinement properties of MST plasmas are tokamak-like when inductive control is used to improved tearing stability. It is reasonable to expect that microturbulence could ultimately govern energy confinement in the RFP, as it does in tokamak plasmas. Measurements of density fluctuations in the strong density gradient region of improved-confinement PPCD plasmas reveal the emergence of short wavelength fluctuations that are identified to be density-gradient-driven trapped electron modes (TEM). The measured fluctuations exhibit a critical gradient-threshold close to gyrokinetic modeling (GENE) predictions, which for TEM is $R/L_n \approx 20$, where $L_n^{-1} = |\nabla n_e|/n_e$. The measured fluctuations have $k_\perp \rho_i \approx 0.1$-$0.2$ and propagate in the electron diamagnetic drift direction. Note that the critical gradient threshold is larger than for tokamak plasmas by roughly the aspect ratio, R/a. ***Impurity transport:*** Impurity transport from drift wave turbulence is an important process in fusion plasmas, sometimes relied on to limit impurity accumulation in advanced tokamak and stellarator configurations. The impurity flux associated with TEM turbulence in MST plasmas has been measured directly using a novel linearized correlation method of active spectroscopy. Since the impurity density is edge-peaked, the flux is locally inward in the edge region. ***Direct measurement of zonal flow:*** Nonlinear GENE simulations predict features for drift turbulence in RFP plasmas that are distinct from behavior in other configurations: intense zonal flow, a very large Dimits-like upshift in the critical gradient, and very small transport [8]. However, residual, small amplitude magnetic fluctuations from tearing instability can disrupt the intense zonal flow, which causes the turbulent flux to saturate at a larger magnitude typical for other magnetic configurations. If tearing can be fully suppressed, anomalous transport might be uniquely small in RFP plasmas. Measurements using two probes with capacitive electrodes separated 180 degrees toroidally that measure the plasma potential directly observe a zonal flow in the edge region of improved-confinement MST plasmas. Such direct observations of zonal flows are rare in fusion research, despite their underlying importance in the formation of transport barriers. [A82,A190,A196,A223,A236,A244,A?A234,A243,A254]

Classical confinement of impurity ions with inductive control of RFP plasmas: "Classical" transport driven by Coulomb collisional scattering represents the fundamental limit for confinement in magnetically confined plasmas. In a tokamak or stellarator plasma, ∇B drifts resulting from the large toroidal field, B_T, cause motion perpendicular to magnetic surfaces that greatly enhances transport by order the safety factor squared, $q^2 \sim 10$, called "neoclassical" transport. The RFP is different in that the ∇B drift is dominantly parallel to magnetic surfaces, hence the lower limit for radial collisional transport is classical. Measurements of the carbon impurity ion profile evolution in MST RFP plasmas using charge-exchange-recombination spectroscopy (CHERS) provided evidence for classical ion transport in a toroidal plasma for the first time. Inductive control (PPCD) was used to create improved-confinement conditions suited for observing the classical transport level, further evidence for tokamak-like confinement characteristics in the RFP when magnetic turbulence is reduced. [A133,A134,A146]

Oscillating Field Current Drive produces 10% of the plasma current: Oscillating Field Current Drive (OFCD) is a form of magnetic helicity injection that could provide efficient, steady-state current sustainment using alternating inductive electric fields. The ac loop voltages are applied in both the toroidal and poloidal directions, and magnetic relaxation processes allow a dc current to be maintained. Up to 10% of the plasma current in MST has been driven by OFCD when moderate-power ac loop voltages are used to augment the usual steady toroidal induction. The relative phasing of the toroidal and poloidal loop voltages which maximizes the OFCD current is different than the optimum predicted by a simple helicity balance, but is in good agreement with nonlinear, 3D, resistive MHD computation [9]. [A14,A27]]

Energy confinement and magnetic relaxation with Oscillating Field Current Drive: The time varying electron thermal confinement during a 200 Hz OFCD cycle has been measured. This was a challenging application of time-resolved MSTFIT equilibrium reconstructions constrained by MST's set of advanced diagnostics. While the electron pressure oscillates, the cycle-average energy confinement is about the same and even slightly better than for steady induction. This bolsters the possibility for current drive by OFCD with the high efficiency typical of induction. ***Magnetic relaxation behavior:*** The heart of magnetic relaxation is a dynamo emf resulting from correlated flow velocity and magnetic field fluctuations, $\mathcal{E}_{||} = \langle \widetilde{\mathbf{V}}_e \times \widetilde{\mathbf{B}} \rangle_{||}$. Experimental measurements of $\mathcal{E}_{||}$ using insertable probes show that the relaxation mechanism operates similarly to the standard RFP, modified slightly by the ac loop voltages. A detailed study of the effects of oscillating poloidal current drive (OPCD) on the dynamics of magnetic relaxation has also been performed to investigate sawtooth entrainment and ion heating. Hence the application of an oscillating inductive electric field is a valuable experimental tool to probe the validity of MHD and extended MHD models. [A96,A104,A121,A253]

Integrated data analysis and accurate measurement of Z_{eff}: Future fusion plasmas will have limited diagnostics available due to the extreme challenges of the fusion nuclear environment. Integrated data analysis (IDA) provides a rigorous methodology to incorporate measurements from multiple sources for greater preservation of the valuable information contained in limited measurements. An example of critical importance to measurements in an ohmically heated RFP plasma is the plasma resistivity. Apart from accurate measurements of ohmic heating, the validation of nonlinear visco-resistive MHD requires knowing the classical resistivity, which scales as $\eta \sim Z_{eff} T_e^{-3/2}$. Various attempts to measure Z_{eff} using bremsstrahlung radiation have been complicated by contamination due to other effects such as molecular excitation. A reliable measurement of Z_{eff} (≈ 2) in MST has been obtained using IDA of combined measurements for soft-x-ray emissivity and charge-exchange-recombination spectroscopy (CHERS). MST has been a leader in the application of IDA techniques to fusion plasmas. [A176,A179,A194,A224,A245,A246,A247]

Improved atomic modeling for the Stark effect: A key diagnostic for magnetic fusion research relies on the motional Stark effect (MSE). This is an atomic process that splits degenerate lines through an effective electric field caused by motion perpendicular to a strong magnetic field, $\mathbf{E} = \mathbf{V} \times \mathbf{B}$. A measurement of the local magnetic field is thus possible by viewing the radiation from energetic atoms injected by a neutral beam. MSE has become the primary means of determining the magnetic field profile in hot fusion plasmas. In MST, the magnitude $|B|$ is measured by fitting the Stark-broadened spectrum. This is different than the polarimetric technique used in tokamaks, where the pitch of the field line is measured, which requires precisely calibrated optical components. For ITER, it is anticipated that the coating of optical components during a single discharge may render the polarimetric technique unusable. The spectral approach developed on MST is less sensitive to these effects. The MST group was an instigator working with the Atomic Database and Analysis Structure (ADAS) project, JET, and DIII-D researchers on improving the atomic model for the Stark effect, since MST was one of the first to use the $|B|$ approach. [A118,A130]

Spontaneous transition to the quasi-single-helicity 3D helical equilibrium: At high current, standard RFP plasmas spontaneously transition from a state with a broad spectrum of tearing modes to a quasi-single-helicity (QSH) regime with a single dominant mode. The confinement improvement provided by a reduction in secondary modes is a promising route to improved confinement in the RFP. An extreme version of the QSH transition, called the single helical axis state (SHAx), was first seen when the RFX-mod experiment pushed toward 2 MA operation. The SHAx state is also obtained in MST, at a lower current of 0.5 MA. The onset in both devices is unified if cast as a scaling with the Lundquist number, a key dimensionless parameter for visco-resistive MHD. This state is stellarator-like in terms of the strength of the helical component of the magnetic field, which can reach 10% of the axisymmetric field component. ***Development of 3D equilibrium reconstructions***: Working in collaboration with Auburn University, ORNL, and RFX-mod, several equilibrium reconstruction codes (V3FIT, NCT and SHEq) have been developed for application to MST's QSH states using data obtained with its extensive diagnostic set, including the multi-chord interferometer-polarimeter (Faraday rotation), 2D soft-x-ray emissivity, Thomson scattering, and a variety of magnetic diagnostics. The orientation of the helical structure is controllable, allowing diagnostics to sample different phases of the helical structure, a potential advantage to understand the optimization of the 3D reconstructions. ***Controlling the 3D plasma orientation using resonant magnetic perturbations***: In the QSH state the MST plasma does not rotate, and the locked-phase of the 3D equilibrium varies quasi-randomly shot-by-shot. A resonant magnetic perturbation (RMP) method has been developed using saddle coils located at a gap in the shell surrounding the plasma that allows robust and flexible control of the locked-phase. This greatly facilitates physics experiments and diagnosis. [A110,A111,A145,A174,A192,A193,A200,A218]

Classical confinement of energetic ions: A fundamental requirement for any fusion plasma is the confinement of the high energy charged particles produced by fusion reactions, most notably alpha particles. The plasma must also remain stable in the presence of these fast ions. Energetic (fast) ions are measured to be very well confined in MST, even in standard RFP plasmas that are largely stochastic. The fast ions are produced using a 1 MW, 25 keV tangential neutral beam injector. By measuring the D-D neutron flux decay in "beam blip" experiments, near classical confinement of energetic ions was confirmed, even in standard RFP plasmas where stochastic energy and particle transport dominates. The measured fast-ion confinement time of >20 ms is much longer than the thermal particle confinement time ∼1 ms. A measured 10% increase in T_e with NBI also agrees with collisional modeling using the TRANSP-NUBEAM transport analysis code developed for tokamak plasmas. Good fast-ion confinement is understood from modeling of the particle orbits and examination of the ion guiding center islands, which can differ substantially from magnetic islands. [A1,A28,A109,A128,A142,A146,A172]

Confinement of energetic ions in the QSH regime: Initial measurements of the confinement of energetic ions in the QSH regime suggested that they experience large neoclassical transport due to a breakage of toroidal symmetry, evidenced by a reduction in the fast ion confinement time relative to the standard RFP regime. Careful analysis and modeling shows that the reduction in confinement time is the result of the residual "secondary modes," i.e., all modes other than the dominant QSH mode, typical toroidal mode number $n > 6$ in MST. When the secondary modes are sufficiently small, the excellent confinement of energetic ions seen in standard RFP plasmas is recovered. This bodes well for an RFP fusion development path that relies on QSH, since the amplitudes of the secondary modes decrease with increasing plasma current and temperature. [A163,A172,A250,A251]

Instabilities excited by energetic ions in an RFP: Energetic particles are a source for plasma instability and a special concern for burning plasmas with alpha heating. The 1 MW neutral beam injector on MST is focused through a small port and creates unusually strong anisotropies in both space and velocity distribution that can excite beam-driven instabilities. Using NBI, such instabilities are observed for the first time in an RFP plasma. Several bursty modes are observed, and their nonlinear interaction induces transport or redistribution of the energetic ions in a predator-prey cycle. The local, on-axis marginal stability threshold for the onset of energetic-particle-driven modes has been measured to be $\beta_{fast}(0) \lesssim 7.5\%$, which is larger than the anticipated alpha particle beta for reactor conditions. One novel mode identified is the magnetic-island-induced Alfvèn eigenmode (MIAE), with the help of a novel analytic calculation for the Alfvèn continuum within a magnetic island (a core-resonant tearing mode in the case of MST plasmas). Collaborations with theory groups elucidated other modes with energetic particle mode (EPM) characteristics. The extensive diagnostic set on MST has allowed rapid characterization of the observed modes, including profiles of their magnetic fluctuations (using FIR polarimetry), a first-time measurement in a toroidal plasma. [A131,A148,A149,A162,A165,A189,A201,A203,A225,A255]

Runaway of energetic ions: An elegant demonstration of the test-particle theory for runaway acceleration has been made for energetic ions created by neutral beam injection. Because their density is relatively low and their energy much higher than the bulk distribution, the NBI-born ions serve as "test" particles. The sawtooth relaxation process drives a large, global change in magnetic flux with a corresponding large inductive electric field $|\mathbf{E}| \sim 50$ V/m. The collisional drag on the energetic ions is weak, allowing runaway acceleration during the sawtooth "crash" event. The increase in ion energy agrees very well with the test-particle theory. While electron runaway is a major issue in tokamak disruption research, there are very few studies of ion runaway, which could be an important part of the non-collisional energization process in both laboratory and astrophysical settings. [A148,A188,A220,A227]

Non-collisional ion energization associated with magnetic reconnection: The ions in RFP plasmas have long been observed to be heated through processes associated with turbulence and magnetic reconnection. This is a powerful heating mechanism, with T_i reaching several keV in the strongest reconnection (sawtooth) events (useful to maximize the plasma pressure and energy confinement, see above). A collection of MST measurements provides new insight on the energization process(es), although a complete theoretical understanding remains elusive. Similar features are observed in astrophysical settings, e.g., the solar corona and wind, suggestive that similar processes may be at work. ***The heating is anisotropic***: Charge-exchange-recombination-spectroscopy (CHERS) provides local measurements of both the parallel and perpendicular temperature (w.r.t. $\mathbf{B}$) of minority ions, revealing $T_{i,\perp} \geqslant T_{i,||}$ during the rapid sawtooth crash of reconnection events, evidencing a highly anisotropic heating mechanism. ***The heating correlates with 3D magnetic structure***: Passive Doppler spectroscopy measurements made simultaneously at several toroidal azimuths reveal that the increase in T_i for minority ions is correlated with magnetic asymmetry. The tearing modes in the RFP are phase-locked through nonlinear coupling such that a localized magnetic "bump" is created. The impurity T_i is also locked to this magnetic structure. ***An energetic ion tail is spontaneously created***: Neutral particle analyzers and D-D neutron measurements reveal that an energetic ion tail is created during the reconnection process. The tail is characterized by a power-law in energy, also commonly observed in astrophysical plasma settings. An excess in neutrons relative to a thermal distribution indicates the ion tail extends to 10's of keV. ***The heating is charge and mass dependent***: Doppler spectroscopy for a variety of minority ion states reveals a charge-to-mass ratio dependence for their temperature increase. Rutherford scattering measurements show that 10-30% of magnetic energy released during reconnection is transferred to the ions, and the increase in the majority ion temperature scales with ion mass roughly as $\Delta T_i \sim \sqrt{m_i}$. [A33,A46,A47,A52,A70,A119,A152,A161,A188,A220]

Electron tail energization during magnetic reconnection: Unlike ions, which are strongly heated during sawtooth reconnection events, the bulk electrons cool. This is consistent with increased magnetic stochasticity during the sawtooth crash. Inspired by the ion dynamics, a fast hard x-ray spectrometer was developed to look for transient electron energization during the ~ 100 μs crash phase. An x-ray tail with a power-law energy spectrum is observed, implying electrons can be energized during reconnection as well. The x-ray tail is anisotropic, with higher emission viewed perpendicular to **B**, implying a perpendicular energization mechanism. This is the first evidence for electron energization in MST plasmas, with characteristics similar to those seen for ion energization. [A199,A230,A238]

Advanced diagnostics enable validation of magnetic-fluctuation-induced transport: Standard RFP plasmas suffer tearing instability, creating a broad spectrum of modes that lead to a stochastic magnetic field. The mode amplitudes vary several-fold during a sawtooth cycle, which provides opportunity for a stringent test of the test-particle theory for stochastic heat transport, $\chi_{st} = v_{th} D_m \sim v_{th} (\widetilde{B}/B)^2$. MST's advanced diagnostics, e.g., pulse-burst Thomson scattering and a three-beam FIR interferometer-polarimeter, provide measurements of the sawtooth dynamics for power balance analysis resolved on the sawtooth timescale, including the $\sim$100 μs crash period. A predicted value for the magnetic diffusivity, $D_m \sim (\widetilde{B}/B)^2$ was derived from nonlinear, 3D, visco-resistive MHD computation performed with a plasma resistivity matching MST parameters. The sawtooth cycle produced in the computation is remarkably similar to that observed in MST. ***Transport in magnetic islands and the transition to stochasticity***: When magnetic islands do not overlap completely, part of the island volume maintains a closed-surface magnetic topology. The high temporal fidelity of MST's fast Thomson scattering diagnostic allowed single-shot measurements of the temperature fluctuation of a rotating magnetic island. This enabled evaluation of electron heat transport in a regime of partial magnetic chaos. Similar residual island structures appear with resonant magnetic perturbations in tokamak plasmas and island divertors in stellarator plasmas, and understanding transport for partial chaos is critical. ***Magnetic fluctuation-induced particle transport***: The electron flux associated with magnetic fluctuations has been directly measured in the plasma core. The divergence of the fluctuation-induced radial flux, $\nabla \cdot \mathbf{\Gamma}_{r,e} \approx 2V_{||e} \langle \partial \widetilde{n}_e / \partial r \cdot \widetilde{B}_r \rangle / B$, was measured using a novel differential interferometer to obtain $\partial n_e / \partial r$ directly. The measured electron flux is larger than the value expected for ambipolar-constrained transport in a stochastic magnetic field. Interestingly, the ion transport appears to be dominated by the fluctuation-induced transport associated with parallel velocity fluctuations, $\mathbf{\Gamma}_{r,i} = n_i \langle \widetilde{V}_{||,i} \widetilde{B}_r \rangle / B$. These results indicate that a more complete theory of particle transport in a stochastic field is required, and may have a physics connection to the surprising particle transport response in the edge of tokamak plasmas when resonant magnetic perturbations are applied. ***Nonambipolar particle transport from magnetic fluctuations***: Measurements of the magnetic fluctuation-induced charge flux, $\mathbf{\Gamma}_q = \langle \widetilde{J}_{||}\widetilde{B}_r\rangle/eB$, in the vicinity of the core-resonant $m = 1$, $n = 6$ tearing mode imply the formation of a localized zonal flow. The current density fluctuation was measured using fast Faraday rotation. While the charge flux is only $\sim$1% of the particle flux, the formation of a local bi-polar $E_r \sim 2$ keV/m and strong zonal flow is implied. The charge flux is large during magnetic reconnection events, and is enhanced by the nonlinear coupling of $m = 1$ and $m = 0$ modes. [A32,A73,A115,A123,A136,A139,A180,A197,A198,A215,A221,A224,A228]

Locking from resonant magnetic perturbations and viscosity from stochastic transport: Resonant magnetic perturbations (RMPs) have become critical to the control of fusion plasmas. They are used to mitigate edge-localized modes in tokamak plasmas and will be important on ITER to avoid ELMs and disruptions. They can also be used to impart plasma rotation. The interaction of RMPs and tearing instabilities affects plasma locking, i.e., a cessation of the natural plasma rotation in the lab frame. The locking dynamics in MST follows expected models for locking, but it is necessary to account for the simultaneous interaction of multiple tearing modes. The perpendicular viscosity that must be used in the torque balance model is larger than expected for collisional transport. Experiments that varied the level of magnetic fluctuations show that the viscosity agrees well with the theoretical value for ambipolar-constrained momentum transport in a stochastic magnetic field, $\nu_\perp = c_s D_{st}$, where $D_{st} = L_c(\widetilde{B}/B)^2$ is the stochastic magnetic field diffusion coefficient, and c_s is the sound speed. This is further confirmation of the test-particle model for transport in a stochastic magnetic field. [A219,A239]

Two-fluid magnetic reconnection: Among the dominant tearing modes in RFP plasmas is the poloidal mode $m = 0$ magnetic reconnection that occurs close to the plasma boundary. Detailed probe measurements establish that two-fluid Hall effects are important for $m = 0$ magnetic reconnection. The dominant effect comes from $\mathbf{J} \times \mathbf{B}$ terms associated with the nonlinear coupling of $m = 0$ and core-resonant $m = 1$ modes. Reconstruction of the reconnected magnetic flux shows that the multiple toroidal harmonics of the $m = 0$ structure superpose to create a contracted X-point region, which might accelerate the reconnection rate. The magnetic measurements were combined with other probe measurements of the plasma flow to provide a comprehensive comparison with the linear mode structure predicted by NIMROD. ***Nonlinear effects and filamentary currents***: Typically, one or two modes are linearly unstable, yet a broad mode spectrum appears through nonlinear coupling. All of the RFP plasma's relaxation processes are strongest when edge-resonant $m = 0$ modes are large, acting as a mediator for nonlinear coupling to core-resonant $m = 1$ modes. Understanding $m = 0$ modes is therefore important. Direct measurements of the linear drive term in the MHD induction equation, $\nabla \times (\widetilde{\mathbf{v}}_{0,1} \times \langle \mathbf{B}\rangle)$, show that the $m = 0$ mode is linearly stable, where subscript (m, n) identifies the poloidal and toroidal mode numbers. Other measurements of the $m = 0$ Ohm's law identify that nonlinear Hall terms, $\widetilde{\mathbf{J}}_{1,n} \times \widetilde{\mathbf{B}}_{1,n+1}$, associated with the coupling of the $m = 0$ and 1 modes is a large force for $m = 0$ reconnection. Also, localized current filaments associated with the $m = 0$ modes have been measured, with features somewhat analogous to the filamentary structures of ELMs in tokamak plasmas. ***Two-fluid magnetic relaxation***: An advanced two-fluid model has been used in nonlinear NIMROD computation [10, 11] to investigate the coupled electron-ion momentum relaxation revealed in MST measurements of the Hall dynamo (a.k.a. Maxwell stress) and Reynolds stress. [A13,A30,A51,A116,A129,A143]

The dynamo mechanism operates through both MHD and Hall effects: Localized measurements in the core and edge have determined that both the MHD dynamo, $\langle \widetilde{\mathbf{v}} \times \widetilde{\mathbf{B}}\rangle_{||}$, and Hall dynamo, $\langle \widetilde{\mathbf{J}} \times \widetilde{\mathbf{B}}\rangle_{||}/en_e$, are operative in MST plasmas. The emergent picture is that the Hall dynamo is dominant near major rational surfaces, for example the $q = 0$ surface near the edge, while the MHD dynamo is dominant away from such surfaces. The two mechanisms operate together. This is predicted by quasi-linear two-fluid theory, and is now under investigation using nonlinear two-fluid computation. Since the Hall dynamo is identically the Maxwell stress for parallel momentum transport, a strong connection between the dynamo and momentum transport processes is implied. [A17,A30,A74,A88]

Momentum transport arises from MHD tearing instability: MST plasmas are observed to rotate spontaneously. The plasma flow has both parallel and perpendicular components that vary with minor radius. During magnetic reconnection events (sawtooth crashes), the parallel flow profile suddenly flattens in about 100 μs. This fast momentum transport arises from the tearing fluctuations, but in a surprising way. The Maxwell stress, $\langle \widetilde{\mathbf{J}} \times \widetilde{\mathbf{B}} \rangle_{||}$, and Reynolds stress, $\rho \langle \widetilde{\mathbf{v}} \cdot \nabla \widetilde{\mathbf{v}} \rangle_{||}$, are each very large relative to the inertial change, but they are oppositely directed. These observations motivated quasilinear MHD theory and numerical studies of momentum transport from tearing instability, which could also be an important mechanism in astrophysical settings such as accretion disks. The connection between the Hall dynamo and momentum transport is now a quintessential feature of two-fluid relaxation. [A34,A55,A69,A74,A252]

MHD dynamo measured in the QSH regime: When operated at higher current, RFP plasmas enter the quasi-single-helicity (QSH) regime and one tearing mode is dominant while the remaining spectrum becomes smaller. An important question is whether or not the dominant mode is solely responsible for the dynamo process in the QSH regime. Taking advantage of MST's advanced plasma flow diagnostics, the MHD dynamo, $\langle \widetilde{\mathbf{v}} \times \widetilde{\mathbf{B}} \rangle_{||}$, was confirmed to be dominated by one tearing mode in QSH plasmas, as predicted by nonlinear resistive MHD simulations. However, a recently completed Ph.D. thesis exploited CHERS to measure the local 3D flow structure for the first time in QSH SHAx plasmas, showing the flow structure is more complex than one single harmonic. A paper by J. Boguski et al has been submitted to PoP reporting these first-time flow velocity measurements. [A56,A226,A257]

Turbulent kinetic stress and spontaneous momentum generation: Spontaneous plasma rotation and momentum transport are key processes in fusion plasma physics. If the plasma does not rotate, it can more easily suffer locked modes that create conditions for plasma instability. In the tokamak, this can lead to disruptions. A new process important for momentum generation and transport has been discovered in MST that involves magnetic turbulence. Fluctuations in the plasma pressure correlated with magnetic field fluctuations generate a kinetic momentum stress, in analogy to the Reynolds and Maxwell stresses. This kinetic stress is measured between sawtooth crash events, when the plasma is observed to spontaneously spin-up. The magnitude and direction for the stress are consistent with it being a potential source for the spontaneous plasma rotation, although the Reynolds and Maxwell stresses are likely important as well. This newly observed momentum transport mechanism could be operative in tokamak plasmas when resonant magnetic perturbations (RMP) are applied. While the physics is related to magnetic fluctuations, which arise from tearing instability in the RFP, the process may not be stochastic, rather a consequence of correlated fluctuations that are more coherent in nature. [A147,A150]

Turbulent cascade of magnetic and kinetic energy: The MST plasma is one of few laboratory plasmas that exhibits broadband magnetized plasma turbulence. Several long-wavelength tearing instabilities interact nonlinearly to energize a broad spectrum of shorter wavelength fluctuations that would otherwise be stable, known as a turbulent cascade. Such cascades are of fundamental importance to turbulence in plasmas and fluids. Measurements of the magnetic turbulence in MST RFP plasmas from the global tearing scale to the ion gyro-radius scale reveal that the spectrum can be understood as a dissipative nonlinear cascade. That is, dissipation occurs simultaneously with the nonlinear energy transfer, and the wavenumber power spectrum exhibits a convolution of a power law and exponential falloff. The turbulence is also anisotropic with respect to $\langle \mathbf{B} \rangle$, a feature predicted by MHD theories. However, the onset of strong dissipation occurs at a scale length longer than expected for classical dissipation, suggestive of important kinetic effects. This is very likely linked to the powerful non-collisional ion energization processes observed in MST plasmas. ***Drift waves in the turbulent cascade***: Probe measurements of broadband electric field fluctuations reveal that the turbulent kinetic energy ($\widetilde{\mathbf{V}} \sim \widetilde{\mathbf{E}} \times \mathbf{B}$) dominates the turbulent magnetic field energy as the fluctuations cascade to smaller scales. This implies the turbulence is not fully Alfvènic. The measured features are consistent with drift waves becoming an energetic component of the turbulence at scales intermediate between tearing and the ion gyroradius, either by nonlinear excitation of stable modes or through gradient-driven instability. Drift waves (TEM) are predicted to be unstable and observed to be the dominant turbulence in the edge of reduced-tearing PPCD plasmas. The pressure gradient in standard plasmas is also large in the edge, so linear TEM instability is possible, or several drift modes could be marginally stable. This is a fascinating case of multi-scale interactions that defines a frontier topic for plasma turbulence, and GENE modeling has been initiated to tackle this grand challenge [8] [A4,A122,A141,A235]

Nonlinear coupling of density fluctuations and fluctuation-induced transport: Plasma density fluctuations are strongly correlated with tearing modes in MST plasmas, through advection induced by the magnetic fluctuations. A novel differential interferometer configuration was created using the FIR laser system on MST to provide high precision measurements of small amplitude density fluctuations. Nonlinear bispectral analysis confirms the standard RFP picture that modes resonant in the core are linearly unstable, while modes resonant in the outer region are energized by nonlinear coupling to the unstable modes. Interestingly, the energy flow in the fluctuations is such that the linear and nonlinear source/sink terms are nearly balanced, with relatively little change in the instantaneous amplitudes of the fluctuations. This is a characteristic feature of turbulent cascades. These measurements also allowed evaluation of the magnetic-fluctuation-induced particle transport flux, mode by mode. [A94,A135]

Radio-frequency heating and current drive using electron Bernstein and lower-hybrid waves: While the RFP's principal advantage as a fusion system is ohmic heating and inductive sustainment, there have been two motivations for the use of radio-frequency heating and current drive in MST. The first is for auxiliary heating that decouples ohmic heating and energy transport, e.g., to investigate beta-limiting mechanisms. This was also a motivation for neutral beam injection discussed above. Second, rf current drive targeted to the outer region of the plasma could provide precise control of the current profile to stabilize tearing modes. Two waves are accessible in MST plasmas, the electron Bernstein wave (EBW, 3.6 GHz) and lower hybrid waves (LH, 800 MHz). Both waves are of interest for future fusion applications in tokamak and stellartor plasmas, and the RFP provides a unique environment to investigate the basic wave physics. Antennas and power systems able to inject $\sim$100 kW were developed for each wave. While this power is too small to significantly compete with the $>$ 1 MW of ohmic heating, basic rf experiments were possible, including the first observation of electron heating using EBW in an RFP plasma. [A11,A12,A15,A79,A77,A164,A124,A214,A233]

HIBP measurements made in the core of improved confinement plasmas: The observed velocity-independent diffusion of energetic electrons in improved-confinement plasmas suggests that electrostatic turbulence could be the dominant cause of transport when magnetic fluctuations are suppressed to a low level. The only diagnostic available for measurement of the electrostatic potential in the core of hot plasmas is the Heavy Ion Beam Probe (HIBP). Improved beam control has allowed first-time HIBP measurements in these strongly time-dependent magnetic equilibria to assess the role of electrostatic turbulence and transport. [A41,A85,A126,A182,A216,A217,A249]

References

[1] S. Peruzzo, M. Agostini, P. Agostinetti, M. Bernardi, P. Bettini, T. Bolzonella, A. Canton, L. Carraro, R. Cavazzana, S. Dal Bello, M. Dalla Palma, G. De Masi, R. Delogu, A. Fassina, L. Grando, P. Innocente, G. Marchiori, N. Marconato, L. Marrelli, N. Patel, M. E. Puiatti, P. Scarin, M. Siragusa, P. Sonato, M. Spolaore, L. Trevisan, M. Valisa, M. Vallar, P. Vincenzi, A. Zamengo, P. Zanca, and L. Zanotto, "Design concepts of machine upgrades for the RFX-mod experiment," Fusion Engineering and Design **123**, 59 (2017).

[2] J. P. Christiansen and K. V. Roberts, "Power balance in an Ohmically heated fusion reactor," Nucl. Fusion **22**, 77 (1982).

[3] R. Dexter, D. Kerst, T. Lovell, S. Prager, and J. Sprott, "The Madison Symmetric Torus," Fusion Tech. **19**, 131 (1991).

[4] J. S. Sarff, A. F. Almagri, J. K. Anderson, T. M. Biewer, A. P. Blair, M. Cengher, B. E. Chapman, P. K. Chattopadhyay, D. Craig, D. J. DenHartog, F. Ebrahimi, G. Fiksel, C. B. Forest, J. A. Goetz, D. Holly, B. Hudson, T. W. Lovell, K. J. McCollam, P. D. Nonn, R. O'Connell, S. P. Oliva, S. C. Prager, J. C. Reardon, M. A. Thomas, M. D. Wyman, D. L. Brower, W. X. Ding, S. D. Terry, M. D. Carter, V. I. Davydenko, A. A. Ivanov, R. W. Harvey, R. I. Pinsker, and C. Xiao, "Tokamak-like confinement at a high beta and low toroidal field in the MST reversed field pinch," Nucl. Fusion **43**, 1684 (2003).

[5] J. K. Anderson, C. B. Forest, T. M. Biewer, J. S. Sarff, and J. C. Wright, "Equilibrium reconstructions of Reversed Field Pinch plasmas," Nucl. Fusion **44**, 162 (2004).

[6] F. Najmabadi, R. W. Conn, R. A. Krakowski, K. R. Schultz, D. Steiner, J. R. Bartlit, C. G. Bathke, J. P. Blanchard, E. T. Cheng, Y. Chu, P. I. H. Cooke, R. L. Creedon, W. P. Duggan, P. J. Gierszewski, N. M. Ghoniem, S. P. Grotz, M. Z. Hasan, C. G. Hoot, W. P. Kelleher, C. E. Kessel, O. K. Kevton, R. C. Martin, R. L. Miller, A. K. Prinja, G. O. Orient, S. Sharafat, E. L. Vold, K. A. Werley, C. P. C. Wong, and D. Sze, "Introduction and synopsis of the TITAN reversed-field-pinch fusion-reactor study," Fusion Eng. Des. **23**, 69 (1993).

[7] M. Greenwald, J. Terry, S. Wolfe, S. Ejima, M. Bell, S. Kaye, and G. Neilson, "A new look at density limits in tokamaks," Nucl. Fusion **28**, 2199 (1988).

[8] Z. R. Williams, M. J. Pueschel, P. W. Terry, and T. Hauff, "Turbulence, transport, and zonal flows in the Madison symmetric torus reversed-field pinch," Physics of Plasmas **24**, 122309 (2017).

[9] F. Ebrahimi, S. C. Prager, J. S. Sarff, and J. C. Wright, "The three-dimensional magnetohydrodynamics of ac helicity injection in the reversed field pinch," Phys. Plasmas **10**, 999 (2003).

[10] J. R. King, C. R. Sovinec, and V. V. Mirnov, "First-order finite-Larmor-radius fluid modeling of tearing and relaxation in a plasma pinch," Phys. Plasmas **19**, 055905 (2012).

[11] J. P. Sauppe and C. R. Sovinec, "Extended MHD modeling of tearing-driven magnetic relaxation," Physics of Plasmas **24**, 056107 (2017).

A Appendix: MST Publications and Presentations Since 2005

A.1 Publications in Refereed Journals and Conference Proceedings

A1. *Observation of weak impact of a stochastic magnetic field on fast-ion confinement*, G. Fiksel, B. Hudson, D.J. Den Hartog, R.M. Magee, R. O'Connell, S.C. Prager, A.D. Beklemishev, V.I. Davydenko, A.A. Ivanov, and Y.A. Tsidulko, Phys. Rev. Lett. **95**, 125001 (2005)
doi:10.1103/PhysRevLett.95.125001

A2. *Overview of results in the MST reversed field pinch experiment*, S.C. Prager, J. Adney, A. Almagri, . Anderson, A. Blair, D.L. Brower, M. Cengher, B.E. Chapman, S. Choi, D. Craig, S. Combs, D.R. Demers, D.J. Den Hartog, B. Deng, W.X. Ding, F. Ebrahimi, D. Ennis, G. Fiksel, R. Fitzpatrick, C. Foust, C.B. Forest, P. Franz, L. Frassinetti, J. Goetz, D. Holly, B. Hudson, M. Kaufman, T. Lovell, L. Marrelli, P. Martin, K. McCollam, V.V. Mirnov, P. Nonn, R. O'Connell, S. Oliva, P. Piovesan, I. Predebon, J.S. Sarff, G. Spizzo, V. Svidzinski, M. Thomas, E. Uchimoto, R. White, and M. Wyman, Nucl. Fusion **45**, S276 (2005)
doi:10.1088/0029-5515/45/10/S23

A3. *Magnetic Reconnection and Self-Organization in Reversed Field Pinch Laboratory Plasmas*, J.S. Sarff, A. Almagri, J.K. Anderson, D.L. Brower, D. Craig, B.H. Deng, D.J. Den Hartog, W.X. Ding, G. Fiksel, C.B. Forest, V. Mirnov, S.C. Prager, V. Svidzinski, in The Magnetized Plasma in Galaxy Evolution, 2004, edited by K. Chyzy, K. Otmianowska-Mazur, M. Soida, and R-J. Dettmar (Obserwatorium Astronomiczne, Uniwersytet Jagiellonski, Krakow, 2005), **48** (2005)
https://ui.adsabs.harvard.edu/abs/2005mpge.conf...48S

A4. *Reduced Intermittency in the Magnetic Turbulence of Reversed Field Pinch Plasmas*, L. Marrelli, L. Frassinetti, P. Martin, D. Craig, and J.S. Sarff, Phys. Plasmas **12**, 030701 (2005)
doi:10.1063/1.1850475

A5. *Perturbative transport studies in the reversed field pinch*, L. Frassinetti, M. Gobbin, L. Marrelli, P. Piovesan, P. Franz, P. Martin, B.E. Chapman, Nucl. Fusion **45**, 1342 (2005)
doi:10.1088/0029-5515/45/11/015

A6. *Dynamo-free plasma in the reversed-field pinch: Advances in understanding the reversed-field pinch improved confinement mode*, J.K. Anderson, J. Adney, A. Almagri, A. Blair, D.L. Brower, M. Cengher, B.E. Chapman, S. Choi, D. Craig, D.R. Demers, D.J. Den Hartog, B. Deng, W.X. Ding, F. Ebrahimi, D. Ennis, G. Fiksel, C.B. Forest, P. Franz, J. Goetz, R.W. Harvey, D. Holly, B. Hudson, M. Kaufman, T. Lovell, L. Marrelli, P. Martin, K. McCollam, V.V. Mirnov, P. Nonn, R. O'Connell, S. Oliva, P. Piovesan, S.C. Prager, I. Predebon, J.S. Sarff, G. Spizzo, V. Svidzinski, M. Thomas, and M.D. Wyman, Phys. Plasmas **12**, 056118 (2005)
doi:10.1063/1.1883666

A7. *Motional stark effect diagnostic for multi-chord measurements of plasma beta in GDT*, G.F. Abdrachitov, P.A. Bagryansky, D.J. Den Hartog, A.A. Ivanov, S.A. Korepanov, A.A. Lizunov, G. Fiksel, and D.A. Khilchenko, Fusion. Sci. Technol. **47**, 159 (2005)
doi:10.13182/FST05-A629

A8. *Status of the GDT experiment and future plans*, A. Abdrashitov, G. Abdrashitov, A. Anikeev, P. Bagryansky, A. Beklemishev, P. Deichuli, A. Ivanov, S. Korepanov, V. Maximov, S. Murakhtin, A. Lizunov, V. Prikhodko, V. Kapitonov, V. Kolmogorov, A. Khil'chenko, V. Mishagin, V. Savkin, A. Shoukaev, G.I. Shulzhenko, A. Solomakhin, A. Sorokin, D. Stepanov, N.V. Stupishin, Y. Tsidulko, A. Zouev,

K. Noack, G. Fiksel, and D.J. Den Hartog. Fusion. Sci. Technol **47**, 27 (2005)
doi:10.13182/FST05-A604

A9. *Soft x-ray pulses in the Reversed Field Pinch*, L. Frassinetti, M. Gobbin, P. Piovesan, L. Marrelli, P. Martin, P. Franz, B.E. Chapman, D. Craig, and J.S. Sarff, IEEE Trans. Plasma Sci. **33**, 462 (2005)
doi:10.1109/TPS.2005.845330

A10. *Imaging of a double helical structure in the reversed field pinch*, F. Bonomo, B.E. Chapman, P. Franz, L. Marrelli, P. Martin, P. Piovesan, I. Predebon, G. Spizzo, R.B. White, IEEE Trans. Plasma Sci. **33**, 458 (2005)
doi:10.1109/TPS.2005.845334

A11. *Lower hybrid experiments on MST*, M.C. Kaufman, J.A. Goetz, M.A. Thomas, D.R. Burke, and D.J. Clayton, Proceedings of the 16th Topical Conference on Radio Frequency Power in Plasmas, AIP Conf. Proc. **787**, 319 (2005)
doi:10.1063/1.2098248

A12. *Lower hybrid antenna design for MST*, J.A. Goetz, M.A. Thomas, M.C. Kaufman, and S.P. Oliva, Proceedings of the 16th Topical Conference on Radio Frequency Power in Plasmas, AIP Conf. Proc. **787**, 323 (2005)
doi:10.1063/1.2098249

A13. *Cause of sudden magnetic reconnection in a laboratory plasma*, S. Choi, D. Craig, F. Ebrahimi, S. C. Prager, Phys. Rev. Lett. **96**, 145004 (2006)
doi:10.1103/PhysRevLett.96.145004

A14. *Oscillating-Field Current-Drive experiments in a reversed field pinch*, K.J McCollam, A.P. Blair, S.C. Prager, J.S. Sarff, Phys. Rev. Lett. **96**, 035003 (2006)
doi:10.1103/PhysRevLett.96.035003

A15. *Coupling to the electron Bernstein wave using a phased array of waveguides in the MST*, M. Cengher, J. K. Anderson, C. B. Forest, V. Svidzinski, Nucl. Fusion **46**, 521 (2006)
doi:10.1088/0029-5515/46/5/004

A16. *Tomographic imaging of resistive mode dynamics in the Madison Symmetric Torus reversed-field pinch*, P. Franz, L. Marrelli, P. Piovesan, I. Predebon, F. Bonomo, L. Frassinetti, P. Martin, G. Spizzo, B.E. Chapman, D. Craig, and J.S. Sarff, Phys. Plasmas **13**, 012510 (2006)
doi:10.1063/1.2160519

A17. *The Hall dynamo effect and nonlinear mode coupling during sawtooth magnetic reconnection*, W. X. Ding, D. L. Brower, B. H. Deng, A. F. Almagri, D. Craig, G. Fiksel, V. Mirnov, S. C. Prager, J. S. Sarff, V. Svidzinski, Phys. Plasmas **13**, 2306 (2006)
doi:10.1063/1.2363353

A18. *Electron density measurement by differential interferometry*, W.X. Ding, D.L. Brower, B.H. Deng, T. Yates, Rev. Sci. Instrum. **77**, 10F105 (2006)
doi:10.1063/1.2229217

A19. *High-speed three-wave polarimeter-interferometer diagnostic for MST*, B.H. Deng, D.L. Brower, W.X. Ding, M.D. Wyman, B.E. Chapman, J.S. Sarff, Rev. Sci. Instrum. **77**, 10F108 (2006)
doi:10.1063/1.2222332

A20. *Advances in neutral-beam-based diagnostics on the Madison Symmetric Torus reversed-field pinch (invited)*, D. J Den Hartog, D. Craig, D. A Ennis, G Fiksel, S Gangadhara, D. J Holly, J. C Reardon, V. I Davydenko, A. A Ivanov, A. A Lizunov, M. G O'Mullane, H. P Summers, Rev. Sci. Instrum. **77**, 10F122 (2006)
doi:10.1063/1.2217920

A21. *Development of fast helium beam emission spectroscopy on MST*, J. W. Ahn, D. Craig, G. Fiksel, D. J. Den Hartog, J. K. Anderson, and M. G. O'Mullane, Rev. Sci. Instrum. **77**, 10F114 (2006)
doi:10.1063/1.2236279

A22. *Local measurements of plasma ion dynamics with optical probes*, A. Kuritsyn, D. Craig, G. Fiksel, M. Miller, D. Cylinder, and M. Yamada. Rev. Sci. Instrum. **77**, 10F112 (2006)
doi:10.1063/1.2220017

A23. *Two-dimensional time resolved measurements of the electron temperature in MST*, P. Franz, F. Bonomo, L. Marrelli, P. Martin, P. Piovesan, G. Spizzo, B. E. Chapman, D. Craig and D. J. Den Hartog, J. A. Goetz and R. O'Connell, S. C. Prager, M. Reyfman, J. S. Sarff, Rev. Sci. Instrum. **77**, 10F318 (2006)
doi:10.1063/1.2229192

A24. *Modeling fast charge exchange recombination spectroscopy measurements from the Madison Symmetric Torus*, S. Gangadhara, D. Craig, D. A. Ennis, D. J. Den Hartog, Rev. Sci. Instrum. **77**, 10F109 (2006)
doi:10.1063/1.2219412

A25. *Onset and saturation of the kink instability in a current-carrying line-tied plasma*, W.F. Bergerson, C.B. Forest, G. Fiksel, D.A. Hannum, R. Kendrick, J.S. Sarff, and S. Stambler, Phys. Rev. Lett., **96**, 015004 (2006)
doi:10.1103/PhysRevLett.96.015004

A26. *Tearing mode driven charge transport and zonal flow in the MST reversed field pinch*, W.X. Ding, D.L. Brower, D. Craig, B.H. Deng, G. Fiksel, V. Mirnov, S. C. Prager, J.S. Sarff, V. Svidzinski, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper EX/P3-19
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node207.htm#42218
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/ex_p3-19.pdf

A27. *Oscillating Field Current Drive in the MST reversed field pinch*, J.S. Sarff, A.F. Almagri, J.K. Anderson, A.P. Blair, D.L. Brower, B.E. Chapman, D. Craig, H.D. Cummings, B.H. Deng, D.J. Den Hartog, W.X. Ding, F. Ebrahimi, D.A. Ennis, G. Fiksel, S. Gangadhara, K.J. McCollam, P.D. Nonn, R. O'Connell, J.A. Reusch, S.C. Prager, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper EX/P6-10
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node362.htm#72179
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/ex_p6-10.pdf

A28. *Confinement of high energy and high temperature ions in the MST reversed field pinch*, G. Fiksel, A.F. Almagri, J.K. Anderson, A.D. Beklemishev, B.E. Chapman, D. Craig, V.I. Davydenko, D.J. Den Hartog, D. Ennis, S. Gangadhara, B. Hudson, A. Kuritsyn, A.A. Ivanov, R.M. Magee, V.V. Mirnov, R. O'Connell, S.C. Prager, J.S. Sarff, V. Svidzinski, Yu.A. Tsidulko, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper EX/P3-6

http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node194.htm#38246
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/ex_p3-6.pdf

A29. *Momentum transport and ion heating from reconnection in the reversed field pinch*, V.A. Svidzinski, F. Ebrahimi, V. V. Mirnov, S. C. Prager, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper TH/P3-20
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node188.htm#36899
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/th_p3-20.pdf

A30. *Two fluid dynamo and edge-resonant m=0 tearing instability in reversed field pinch*, V.V. Mirnov, C.C. Hegna, S.C. Prager, C.R. Sovinec, H. Tian, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper TH/P3-18
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node186.htm#36729
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/th_p3-18.pdf

A31. *Equilibrium evolution in the ZaP Flow Z-Pinch*, U. Shumlak, C. S. Adams, R. P. Golingo, D. J. Den Hartog, S. L. Jackson, S. D. Knecht, K. A. Munson, B. A. Nelson, and the ZaP Team, Fusion Energy 2006, Proceedings of the 21st IAEA Conference, Chengdu, 16-21 October, 2006. ISBN 92-0-100907-0 / ISSN 1991-2374, paper IC/P7-11
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/html/node455.htm#90436
http://www-naweb.iaea.org/napc/physics/FEC/FEC2006/papers/ic_p7-11.pdf

A32. *Nonambipolar Magnetic-Fluctuation-Induced Particle Transport and Plasma Flow in the MST Reversed-Field Pinch*, W.X. Ding, D.L. Brower, D. Craig, B.H. Deng, S.C. Prager, J.S. Sarff, and V. Svidzinski, Phys. Rev. Lett. **99**, 055004 (2007)
doi:10.1103/PhysRevLett.99.055004

A33. *Spatially resolved measurements of ion heating during impulsive reconnection in the Madison Symmetric Torus*, S. Gangadhara, D. Craig, D. A. Ennis, D. J. Den Hartog, G. Fiksel, and S. C. Prager. Phys. Rev. Lett. **98**, 075001 (2007)
doi:10.1103/PhysRevLett.98.075001

A34. *Momentum transport from current-driven reconnection in the reversed field pinch*, F. Ebrahimi, V. V. Mirnov, S. C. Prager, C. R. Sovinec Phys. Rev. Lett. **99**, 075003 (2007)
doi:10.1103/PHYSREVLETT.99.075003

A35. *Emission intensities and line ratios from a fast neutral helium beam*, J-W Ahn, D. Craig, G. Fiksel, D. J. Den Hartog, J. K. Anderson, and M. G O'Mullane, Phys. Plasmas **14**, 083301 (2007)
doi:10.1063/1.2759191

A36. *Experimental tests of paleoclassical transport*, J.D. Callen, J.K. Anderson, T.C. Arlen, G. Bateman, R.V. Budny, T. Fujita, C.M. Greenfield, M. Greenwald, R.J. Groebner, D.N. Hill, G.M.D. Hogeweij, S.M. Kaye, A.H. Kritz, E.A. Lazarus, A.C. Leonard, M.A. Mahdavi, H.S. McLean, T.H. Osborne, A.Y. Pankin, C.C. Petty, J.S. Sarff, H.E. St John, W.M. Stacey, D. Stutman, E.J. Synakowski and K. Tritz, Nucl. Fusion **47**, 1449 (2007)
doi:10.1088/0029-5515/47/11/006

A37. *Recent improvements in confinement and beta in the MST reversed-field pinch*, D.J. Den Hartog, J.-W, Ahn, A.F. Almagri, J. K. Anderson, A. D. Beklemishev, A. P. Blair, F. Bonomo, M. T. Borchardt, D. L. Brower, D. R. Burke, M Cengher, B. E. Chapman, S. Choi, D. J. Clayton, W. A. Cox, S. K. Combs,

D. Craig, H. D. Cummings, V. I. Davydenko, D. R. Demers, B. H. Deng, W. X. Ding, F. Ebrahimi, D. A. Ennis, G. Fiksel, C. Foust, C. B. Forest, P. Franz, L. Frassinetti, S. Gangadhara, J. A. Goetz, R. W. Harvey, D. J. Holly, B. F. Hudson, A. A. Ivanov, M. C. Kaufman, A. V. Kuritsyn, A. A. Lizunov, T. W. Lovell, R. M. Magee, L. Marrelli, P. Martin, K. J. McCollam, M. C. Miller, V. V. Mirnov, P. D. Nonn, R. O'Connell, S. P. Oliva, P. Piovesan, S. C. Prager, I Predebon, J. A. Reusch, J. S. Sarff, V. A. Svidzinski, T. D. Tharp, M. A. Thomas, Yu. A. Tsidulko, M. D. Wyman, T. Yates. Nucl. Fusion **47**, L17 (2007). (Overview presenation at IAEA FEC 2006, Chengdu, China)
doi:10.1088/0029-5515/47/9/L01

A38. *Finite temperature effects on interferometry and polarimetry measurements in fusion plasmas*, V.V. Mirnov, W.X. Ding, D.L. Brower, M.A. Van Zeeland, T.N. Carlstrom, Phys. Plasmas **14**, 102105 (2007)
doi:10.1063/1.2790886

A39. *Numerical studies of active current profile control in the reversed-field pinch*, J.-E. Dahlin, J. Scheffel, J.K. Anderson, Plasma Phys. and Contr. Fusion **49**, 183 (2007)
doi:10.1088/0741-3335/49/2/008

A40. *High throughput spectrometer for fast localized Doppler measurements*, D. Craig, D. J. Den Hartog, D. A. Ennis, S. Gangadhara, D. Holly, Rev. Sci. Instrum. **78**, 013103 (2007)
doi:10.1063/1.2424450

A41. *Computer simulation of three-dimensional heavy ion beam trajectory imaging techniques used for magnetic field estimation*, C. Ling, K.A. Connor, D.R. Demers, R.J. Radke, P.M. Schoch, Rev. Sci. Instrum. **78**, 113505 (2007)
doi:10.1063/1.2804108

A42. *Validating the lower hybrid interdigital-line antenna on MST*, M.C. Kaufman, J.A. Goetz, D.R. Burke, A.F. Almagri, S.P. Oliva, and J.G. Kulpin, Proceedings of the 17th Topical Conference on Radio Frequency Power in Plasmas, AIP Conf. Proc. **933**, 309 (2007)
doi:10.1063/1.2800500

A43. *Diagnosis of lower hybrid on MST*, D.R. Burke, J.A. Goetz, M.C. Kaufman, A.F. Almagri, J.K. Anderson, C.B. Forest, and S.C. Prager, Proceedings of the 17th Topical Conference on Radio Frequency Power in Plasmas, AIP Conf. Proc. **787**, 313 (2007)
doi:10.1063/1.2800501

A44. *Chair summaries from the 2006 Innovative Confinement Concepts (ICC) Workshop*, D. Craig, R. Goldston, T.R. Jarboe, B.A. Nelson, C.R. Sovinec, S. Woodruff, and G. Wurden, J. Fusion Energy **26**, 3 (2007)
doi:10.1007/s10894-006-9073-y

A45. *High-beta, improved confinement reversed-field pinch plasmas at high density*, M. D. Wyman, B. E. Chapman, J. W. Ahn, A. F. Almagri, J. K. Anderson, F. Bonomo, D. L. Brower, S. K. Combs, D. Craig, D. J. Den Hartog, B. H. Deng, W. X. Ding, F. Ebrahimi, D. A. Ennis, G. Fiksel, C. R. Foust, P. Franz, S. Gangadhara, J. A. Goetz, R. O'Connell, S. P Oliva, S. C. Prager, J. A. Reusch, J. S. Sarff, H. D. Stephens, and T. Yates, Phys. Plasmas. **15**, 010701 (2008)
doi:10.1063/1.2835439

A46. *Ion heating during reconnection in the Madison Symmetric Torus reversed field pinch*, S. Gangadhara, D. Craig, D. A Ennis, D. J Den Hartog, G. Fiksel, and S.C. Prager. Phys. Plasmas **15**, 6121 (2008)
doi:10.1063/1.2884038

A47. *Anomalous impurity ion heating from Alfvenic cascade in the reversed field pinch*, Varun Tangri, P. W. Terry, and Gennady Fiksel, Phys. Plasmas **15**, 112501 (2008)
doi:10.1063/1.2998829

A48. *Internal magnetic field structures and parallel electric field profile evolution during the sawtooth cycle in MST*, B.H. Deng, W.X. Ding, D.L. Brower, A.F, Almagri, K.J. McCollam,Y. Ren, S.C. Prager, J.S. Sarff, J. Reusch and J.K. Anderson, Plasma Phys. Control. Fusion **50** 115013 (2008)
doi:10.1088/0741-3335/50/11/115013

A49. *Current sustainment scenarios for a reversed field pinch fusion reactor*, J.S. Sarff, J. Plasma Fusion Res. **84**, 800 (2008) (in Japanese)
http://www.jspf.or.jp/Journal/PDF_JSPF/jspf2008_11/jspf2008_11-800.pdf

A50. *Role of MST in activities of the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas (CMSO)*, G. Fiksel, J. Plasma Fusion Res. **84**, 804 (2008) (in Japanese)
http://www.jspf.or.jp/Journal/PDF_JSPF/jspf2008_11/jspf2008_11-804.pdf

A51. *Filamentary current structures in the Madison Symmetric Torus*, P. Piovesan, A. Almagri, B.E. Chapman, D. Craig, L. Marrelli, P. Martin, S.C. Prager, J.S. Sarff, Nucl. Fusion **48**, 095003 (2008)
doi:10.1088/0029-5515/48/9/095003

A52. *Modeling of ion heating from viscous damping of reconnection flows in the reversed field pinch*, V. A. Svidzinski. G Fiksel, V. V Mirnov, S. C Prager, Phys. Plasmas **15**, 062511 (2008)
doi:10.1063/1.2937121

A53. *Stochastic magnetic field driven charge transport and zonal flow during magnetic reconnection*, W. X. Ding, D. L. Brower, D. Craig, B. E. Chapman, D. Ennis, G. Fiksel, S. Gangadhara, D. J. Den Hartog, V. V. Mirnov, S. C .Prager, J. S. Sarff, V. Svidzinski, P. W. Terry, and T. Yates, Phys. Plasmas **15**, 055901 (2008)
doi:10.1063/1.2837047

A54. *Nonlinear magnetohydrodynamics of pulsed parallel current drive in reversed-field pinches*, J. M. Reynolds, C. R. Sovinec, S. C. Prager Phys. Plasmas **15**, 062512 (2008)
doi:10.1063/1.2937770

A55. *Momentum transport from tearing modes with shear flow*, F. Ebrahimi, V. V. Mirnov, S. C. Prager Phys. Plasmas **15**, 055701 (2008)
doi:10.1063/1.2838247

A56. *High current regimes in RFX*, M. Valisa, T. Bolzonella, P. Buratti, L. Carraro, R. Cavazzana, S. Dal Bello, P. Martin, R. Pasqualotto, J. S. Sarff, M. Spolaore, P. Zanca, L. Zanotto, M. Agostini, A. Alfier, V. Antoni, L. Apolloni, F. Auriemma, O. Barana, M. Baruzzo, P. Bettini, D. Bonfiglio, F. Bonomo, M. Brombin, A. Buffa, A. Canton, S. Cappello, M. Cavinato, G. Chitarin, A. De Lorenzi, G. De Masi, D. F. Escande, A. Fassina, P. Franz, E. Gaio, E. Gazza, L. Giudicotti, F. Gnesotto, M. Gobbin, L. Grando, L. Guazzotto, S. C. Guo, V. Igochine, P. Innocente, R. Lorenzini, A. Luchetta, G. Manduchi, G. Marchiori, D. Marcuzzi, L. Marrelli, S. Martini, E. Martines, K. McCollam, F. Milani, M. Moresco, L. Novello, S. Ortolani, R. Paccagnella, S. Peruzzo, R. Piovan, L. Piron, A. Pizzimenti, P. Piovesan, N. Pomaro, I. Predebon, M. E. Puiatti, G. Rostagni, F. Sattin, P. Scarin, G. Serianni, P. Sonato, E. Spada, A. Soppelsa, S. Spagnolo, G. Spizzo, C. Taliercio, D. Terranova, V. Toigo, N. Vianello, D. Yadikin, P. Zaccaria, B. Zaniol, E. Zilli and M. Zuin, Plasma Phys. Control. Fusion **50**, 124031 (2008)
doi:10.1088/0741-3335/50/12/124031

A57. *Advanced interferometry techniques for burning plasmas*, D.L. Brower, W.X. Ding, V.V. Mirnov, M.A. VanZeeland, T.N. Carlstrom, in *Burning Plasma Diagnostics*, edited by F.P. Orsitto, G. Gorini, E. Sindoni, and M. Tardocchi, AIP Conference Proceedings **988**, Melville New York, 2008
doi:10.1063/1.2905125

A58. *Probes for measuring fluctuation-induced Maxwell and Reynolds stresses in the edge of the Madison Symmetric Torus reversed field pinch*, A. Kuritsyn, G. Fiksel, M.C. Miller, A.F. Almagri, M. Reyfman, J.S. Sarff, Rev. Sci. Instrum. **79**, 10F127 (2008)
doi:10.1063/1.2955930

A59. *Measurement of magnetic fluctuation-induced particle flux*, W.X. Ding, D.L. Brower, T.F. Yates, Rev. Sci. Instrum. **79**, 10E701 (2008)
doi:10.1063/1.2953437

A60. *Simultaneous density and magnetic field fluctuation measurements by far-infrared polarimetry and interferometry*, T.F. Yates, W.X. Ding, T.A. Carter, D.L. Brower, Rev. Sci. Instrum. **79**, 10E714 (2008)
doi:10.1063/1.2966377

A61. *Multipoint Thomson scattering diagnostic for the Madison Symmetric Torus reversed-field pinch*, J. A. Reusch, M. T. Borchardt, D. J. Den Hartog, A. F. Falkowski, D. J. Holly, R. O'Connell, H. D. Stephens, Rev. Sci. Instrum. **79**, 10E733 (2008)
doi:10.1063/1.2956742

A62. *Calibration of a Thomson scattering diagnostic for fluctuation measurements*, H. D. Stephens, M. T. Borchardt,D. J. Den Hartog, A. F. Falkowski, D. J. Holly, R. O'Connell, J. A. Reusch, Rev. Sci. Instrum. **79**, 10E734 (2008). doi:10.1063/1.2964229

A63. *Optimizing a Thomson scattering diagnostic for fast dynamics and high background*, R. O'Connell, D. J. Den Hartog, M. T. Borchardt, D. J. Holly, J. A. Reusch, and H. D. Stephens, Rev. Sci. Instrum. **79**, 10E735 (2008)
doi:10.1063/1.2957844

A64. *A pulse-burst laser system for a high-repetition-rate Thomson scattering diagnostic*, D. J. Den Hartog, N. Jiang, W. R. Lempert, Rev. Sci. Instrum **79**, 10E736 (2008)
doi:10.1063/1.2965733

A65. *Mini-conference on angular momentum transport in laboratory and nature*, Hantao Ji, Philipp Kronberg, Stewart C. Prager, Dmitri A. Uzdensky, and Center for Magnetic Self-organization in Laboratory and Astrophysical Plasmas, Phys. Plasmas **15**, 058302 (2008)
doi:10.1063/1.2902348

A66. *A 100 kilovolt phase control thyristor switch stack*, J.G. Kulpin, Proceedings of the 2008 International Power Modulators and High Voltage Conference, IEEE Catalog 08CH37938, 378 (2008)
doi:10.1109/IPMC.2008.4743664

A67. *Observation of resistive and ferric wall modes in a line tied pinch*, W. F. Bergerson, D. A. Hannum, C. C. Hegna, R. D. Kendrick, J. S. Sarff, and C. B. Forest, Phys. Rev. Lett. **101**, 235005 (2008)
doi:10.1103/PhysRevLett.101.235005

A68. *Overview of results in the MST Reversed Field Pinch*, G. Fiksel, A. F. Almagri, J. K. Anderson, F. Bonomo, M. T. Borchardt, D. L. Brower, D. R. Burke, K. Caspary, B. E. Chapman, D. J. Clayton,

W. A. Cox, D. Craig, V. I. Davydenko, D. R. Demers, D. J. Den Hartog, B. H. Deng, W. X. Ding, F. Ebrahimi, D. A. Ennis, C. Foust, C. B. Forest, P. Franz, L. Frassinetti, S. Gangadhara, J. A. Goetz, R. W. Harvey, D. J. Holly, A. A. Ivanov, M. C. Kaufman, A. V. Kuritsyn, R. M. Magee, L. Marrelli, P. Martin, K. J. McCollam, M. C. Miller, V. V. Mirnov, P. D. Nonn, R. O'Connell, S. P. Oliva, P. Piovesan, S. C. Prager, J. A. Reusch, J. S. Sarff, H. D. Stephens, V. Svidzinski, V. Tangri, P. W. Terry, T. D. Tharp, M. D. Wyman, Fusion Energy 2008, Proceedings of the 22nd IAEA Conference, Geneva, 13-18 October, 2008. Paper OV/5-2Rb
https://www-pub.iaea.org/MTCD/Meetings/FEC2008/ov_5-2rb.pdf

A69. *Momentum transport from tearing instability*, S.C. Prager, A.F. Almagri, D.L. Brower, D. Craig, D.J. Den Hartog, W. Ding, F. Ebrahimi, A. Kuritsyn, M. Miller, V.V. Mirnov, J.S. Sarff, and the MST Team, Fusion Energy 2008, Proceedings of the 22nd IAEA Conference, Geneva, 13-18 October, 2008. Paper EX/P-5-3
https://www-pub.iaea.org/MTCD/Meetings/FEC2008/ex_p5-3.pdf

A70. *Role of Impurity Cyclotron Damping in Ion Heating and RFP Turbulence*, P.W. Terry, V. Tangri, J.S. Sarff, G. Fiksel, A.F. Almagri, Y. Ren, and S.C. Prager, Fusion Energy 2008, Proceedings of the 22nd IAEA Conference, Geneva, 13-18 October, 2008. Paper TH/P8-43
https://www-pub.iaea.org/MTCD/Meetings/FEC2008/th_p8-43.pdf

A71. *High beta plasmas exceeding dual stability thresholds in the MST RFP*, B.E. Chapman, M.D. Wyman, J.W. Ahn, A.F. Almagri, J.K. Anderson, F. Bonomo, D.L.Brower, S.K. Combs, D. Craig,, D.J. Den Hartog, B.H. Deng, W.X. Ding, F. Ebrahimi, D.A. Ennis, G.Fiksel, C.R. Foust, P. Franz, S. Gangadhara, J.A. Goetz, R. O'Connell, S.P. Oliva, S.C. Prager, J.A. Reusch, J.S. Sarff, H.D. Stephens, and T. Yates, Fusion Energy 2008, Proceedings of the 22nd IAEA Conference, Geneva, 13-18 October, 2008. Paper EX/7-1Ra
https://www-pub.iaea.org/MTCD/Meetings/FEC2008/ex_7-1ra.pdf

A72. *Overview of RFX-Mod results*, P. Martin, L. Apolloni, M. E. Puiatti, J. Adamek, M. Agostini, A. Alfier, S.V. Annibaldi, V. Antoni, F. Auriemma, O. Barana, M. Baruzzo, P. Bettini, T. Bolzonella, D. Bonfiglio, F. Bonomo, M. Brombin, J. Brotankova), A. Buffa, P. Buratti, A. Canton, S. Cappello, L. Carraro, R. Cavazzana, M. Cavinato, B.E. Chapman, G. Chitarin, S. Dal Bello, A. De Lorenzi, G. De Masi, D. F. Escande, A. Fassina, A. Ferro, P. Franz, E. Gaio, E. Gazza, L. Giudicotti, F. Gnesotto, M. Gobbin, L. Grando, L. Guazzotto, S. C. Guo, V. Igochine, P. Innocente, Y.Q.Liu, R. Lorenzini, A. Luchetta, G. Manduchi, G. Marchiori, D. Marcuzzi, L. Marrelli, S. Martini, E. Martines, K. McCollam, F. Milani, M. Moresco, L. Novello, S. Ortolani, R. Paccagnella, R. Pasqualotto, S. Peruzzo, R. Piovan, P. Piovesan, L. Piron, A. Pizzimenti, N. Pomaro, I. Predebon, J.A. Reusch, G. Rostagni, G. Rubinacci, J. S. Sarff, F. Sattin, P. Scarin, G. Serianni, P. Sonato, E. Spada, A. Soppelsa, S. Spagnolo, M. Spolaore, G. Spizzo, C. Taliercio, D. Terranova, V. Toigo, M. Valisa, N. Vianello, F. Villone, D. Yadikin, P. Zaccaria, A. Zamengo, P. Zanca, B. Zaniol, L. Zanotto, E. Zilli, H. Zohm, M. Zuin, Fusion Energy 008, Proceedings of the 22nd IAEA Conference, Geneva, 13-18 October, 2008. Paper OV/5-2Ra
https://www-pub.iaea.org/MTCD/Meetings/FEC2008/ov_5-2ra.pdf

A73. *Magnetic fluctuation-induced particle transport and density relaxation in a high-temperature plasma*, W.X. Ding, D.L. Brower, G. Fiksel, D. J. Den Hartog, S.C. Prager, J.S. Sarff, Phys. Rev. Lett. **103**, 025001 (2009)
doi:10.1103/PhysRevLett.103.025001

A74. *Measurements of the momentum and current transport from tearing instability in the MST reversed-field pinch*, A. Kuritsyn, G. Fiksel, A.F. Almagri, D.L. Brower, W.X. Ding, M.C. Miller, V.V. Mirnov, S.C. Prager, and J.S. Sarff. Phys. Plasmas **16**, 055903 (2009)
doi:10.1063/1.3090325

A75. *Plasma behavior at high beta and high density in the Madison Symmetric Torus RFP*, M.D. Wyman, B.E. Chapman, J.W. Ahn, A.F. Almagri, J.K. Anderson, F. Bonomo, D.L. Brower, S.K. Combs, D. Craig, D.J. Den Hartog, B.H. Deng, W.X. Ding, F. Ebrahimi, D.A. Ennis, G. Fiksel, C.R. Foust, P. Franz, S. Gangadhara, J.A. Goetz, R. O'Connell, S.P. Oliva, S.C. Prager, J.A. Reusch, J.S. Sarff, H.D. Stephens and T. Yates, 2009 Nucl. Fusion **49**, 015003 (2009)
doi:10.1088/0029-5515/49/1/015003

A76. *Interferometry Techniques for Fusion Plasmas*, D.L. Brower, W.X. Ding, V.V. Mirnov, M.A. vanZeeland, T.N. Carlstrom, Fusion Sci. and Tech. 56, 983 (2009)
doi:10.13182/FST09-A9038

A77. *Electron Bernstein Wave experiment on the Madison Symmetric Torus*, J.K. Anderson, D.R. Burke, C.B. Forest, J.A. Goetz, M.C. Kaufman, and A.H. Seltzman, Proceedings of the 18th Topical Conference on Radio Frequency Power in Plasmas (2009)
doi:10.1063/1.3273789

A78. *Improved Confinement Plasmas at High Temperature and High Beta in the MST RFP*, B.E. Chapman, J.W. Ahn, A.F. Almagri, J.K. Anderson, F. Bonomo, D.L. Brower, D.R. Burke, K. Caspary, D.J. Clayton, S.K. Combs, W.A. Cox, D. Craig, B.H. Deng, D.J. Den Hartog, W.X. Ding, F. Ebrahimi, D.A. Ennis, G. Fiksel, C.B. Forest, C.R. Foust, P. Franz, S. Gangadhara, J.A. Goetz, M.C. Kaufman, J.G. Kulpin, A. Kuritsyn, R.M. Magee, M.C. Miller, V.V. Mirnov, P.D. Nonn, R. OConnell, S.P. Oliva, S.C. Prager, J.A. Reusch, J.S. Sarff, H.D. Stephens, M.D. Wyman, T. Yates, Nucl. Fusion 49, (2009)
doi:10.1088/0029-5515/49/10/104020

A79. *Overview of MST LHRF Experiments*, M.C. Kaufman, D.R. Burke, J.A. Goetz, Proceedings of the 18th Topical Conference on Radio Frequency Power in Plasmas, CP 1187, 335 (2009)
doi:10.1063/1.3273761

A80. *Mass-Dependent Ion Heating during Magnetic Reconnection in a Laboratory Plasma*, G Fiksel, A. F. Almagri, B. E. Chapman, V. V. Mirnov, Y. Ren, J. S. Sarff, and P. W. Terry, Phys. Rev. Lett. 103, 145002 (2009)
doi:10.1103/PhysRevLett.103.145002

A81. *Overview of RFX-mod results*, P. Martin, L. Apolloni, M.E. Puiatti, J. Adamek, M. Agostini, A. Alfier, S.V. Annibaldi, V. Antoni, F. Auriemma, O. Barana, M. Baruzzo, P. Bettini, T. Bolzonella, D. Bonfiglio, F. Bonomo, M. Brombin, J. Brotankova, A. Buffa, P. Buratti, A. Canton, S. Cappello, L. Carraro, R. Cavazzana, M. Cavinato, B.E. Chapman, G. Chitarin, S. Dal Bello, A. De Lorenzi, G. De Masi, D.F. Escande, A. Fassina, A. Ferro, P. Franz, E. Gaio, E. Gazza, L. Giudicotti, F. Gnesotto, M. Gobbin, L. Grando, L. Guazzotto, S.C. Guo, V. Igochine, P. Innocente, Y.Q. Liu, R. Lorenzini, A. Luchetta, G. Manduchi, G. Marchiori, D. Marcuzzi, L. Marrelli, S. Martini, E. Martines, K. McCollam, S. Menmuir, F. Milani, M. Moresco, L. Novello, S. Ortolani, R. Paccagnella, R. Pasqualotto, S. Peruzzo, R. Piovan, P. Piovesan, L. Piron, A. Pizzimenti, N. Pomaro, I. Predebon, J.A. Reusch, G. Rostagni, G. Rubinacci, J.S. Sarff, F. Sattin, P. Scarin, G. Serianni, P. Sonato, E. Spada, A. Soppelsa, S. Spagnolo, M. Spolaore, G. Spizzo, C. Taliercio, D. Terranova, V. Toigo, M. Valisa, N. Vianello, F. Villone, R.B. White1, D. Yadikin, P. Zaccaria, A. Zamengo, P. Zanca, B. Zaniol, L. Zanotto, E. Zilli,

H. Zohm and M. Zuin, Nucl. Fusion 49, 104019 (2009)
doi:10.1088/0029-5515/49/10/104019

A82. *Generation and confinement of hot ions and electrons in a reversed-field pinch plasma*, B. E. Chapman, A. F. Almagri, J. K. Anderson, D. L.Brower, K. Caspary, J. D. J.Clayton, D. Craig, D. J. Den Hartog, W. X. Ding, D. A. Ennis, G. Fiksel, S. Gangadhara, S. Kumar, R. M. Magee, R. O'Connell, E. Parke, S. C. Prager, J. A. Reusch, J. S. Sarff, H. D. Stephens, Y. M. Yang, Plasma Phys. Control. Fusion 52, 124048 (2010)
doi:10.1088/0741-3335/52/12/124048

A83. *An upgraded x-ray spectroscopy diagnostic on MST*, D.J. Clayton, A.F. Almagri, D.R. Burke, C.B. Forest, J.A. Goetz, M.C. Kaufman, and R. O'Connell, Rev. Sci. Instr. 81, 10E308 (2010)
doi:10.1063/1.3478977

A84. *Observation of energetic electron confinement in a largely stochastic reversed-field pinch plasma*, D. J. Clayton, B. E. Chapman, R. O'Connell, A. F. Almagri, D. R. Burke, C. B. Forest, J. A. Goetz, M. C. Kaufman, F. Bonomo, P. Franz, M. Gobbin, P. Piovesan, Phys. Plasmas 17, 012505 (2010)
doi:10.1063/1.3292658

A85. *Heavy ion beam probe operation in time varying equilibria of improved confinement reversed field pinch discharges*, D. R. Demers, X. Chen, P. M. Schoch, P. J. Fimognari, Rev. Sci. Instrum. 81, 10E109 (2010)
doi:10.1063/1.3479109

A86. *Pulse-burst operation of standard Nd:YAG lasers*, D. J. Den Hartog, J. R. Ambuel, M. T. Borchardt, J.A. Reusch, P. E. Robl, and Y. M. Yang, J. Phys.: Conf. Ser. 227, 012023 (2010)
doi:10.1088/1742-6596/227/1/012023

A87. *Pulse-burst laser systems for fast Thomson scattering (invited)*, D. J. Den Hartog, J. R. Ambuel, M. T. Borchardt, A. F. Falkowski, W. S. Harris, D. J. Holly, E. Parke, J. A. Reusch, P. E. Robl, H. D. Stephens, and Y. M. Yang, Rev. Sci. Instrum. 81, 10D513 (2010)
doi:10.1063/1.3475723

A88. *Local measurements of tearing mode flows and the magnetohydrodynamic dynamo in the Madison Symmetric Torus reversed-field pinch*, D. A. Ennis, D. Craig, S. Gangadhara, J. K. Anderson, D. J. Den Hartog, F. Ebrahimi, G. Fiksel, and S. C. Prager, Phys. Plasmas 17, 082102 (2010)
doi:10.1063/1.3458667

A89. *Port hole perturbations to the magnetic field in MST*, P. J. Fimognari, A. F. Almagri, J. K. Anderson, D. R. Demers, J. S. Sarff, V. Tangri, and J. Waksman, Plasma Phys. Control. Fusion 52, (2010)
doi:10.1088/0741-3335/52/9/095002

A90. *Note: Zeeman splitting measurements in a high-temperature plasma*, R. P. Golingo, U. Shumlak, and D. J. Den Hartog, Rev. Sci. Instrum. 21, 126104 (2010)
doi:10.1063/1.3509400

A91. *Initial operation of a pulse-burst laser system for high-repetition-rate Thomson scattering*, W.S. Harris, D. J. Den Hartog, N. C. Hurst, Rev. Sci. Instr. 81, 10D505 (2010)
doi:10.1063/1.3466901

A92. *Two-point motional Stark effect diagnostic for Madison Symmetric Torus*, J. Ko, D. J. Den Hartog, K. J. Caspary, E. A. Den Hartog, N. A. Pablant, and H. P. Summers, Rev. Sci. Instrum. 81, 10D702

(2010)
doi:10.1063/1.3461995

A93. *Toroidal charge exchange recombination spectroscopy measurements on MST*, R. M. Magee, D. J. Den Hartog, G. Fiksel, S. T. A. Kumar, and D. Craig, Rev. Sci. Instrum. 81, 10D716 (2010)
doi:10.1063/1.3478665

A94. *Differential Interferometry for Measurement of Density Fluctuations and Fluctuation-Induced Transport*, L. Lin, W. X. Ding, D. L. Brower, W. F. Bergerson, and T. F. Yates, Rev. Sci. Instrum. 81, 10D509 (2010)
doi:10.1063/1.3464480

A95. *Upgrade of Far-Infrared Laser-Based Faraday Rotation Measurement on MST*, W.X. Ding, D.L. Brower, W.F. Bergerson, L. Lin, Rev. Sci. Instrum. 81, 10D508 (2010)
doi:10.1063/1.3466898

A96. *Equilibrium evolution in oscillating-field current-drive experiments*, K. J. McCollam, J. K. Anderson, A. P. Blair, D. Craig, D. J. Den Hartog, F. Ebrahimi, R. O'Connell, J. A. Reusch, J. S. Sarff, H. D. Stephens, D. R. Stone, D. L. Brower, B. H. Deng, W. X. Ding, Phys. Plasmas 17, 082506 (2010)
doi:10.1063/1.3461167

A97. *A new double-foil soft x-ray array to measure Te on the MST reversed field pinch*, M.B. McGarry, P. Franz, D.J. Den Hartog, J.A. Goetz, Rev. Sci. Instrum. 81, 10E516 (2010)
doi:10.1063/1.3481167

A98. *Electron thermal transport within magnetic islands in the reversed-field pinch*, H. D. Stephens, D. J. Den Hartog, C. C. Hegna, and J. A. Reusch, Phys. Plasmas 17, 056115 (2010)
doi:10.1063/1.3388374

A99. *Measurements of impulsive reconnection driven by nonlinear Hall dynamics*, T. D. Tharp, A. F. Almagri, M. C. Miller, V. V. Mirnov, S. C. Prager, Phys. Plasmas 17, 120701 (2010)
doi:10.1063/1.3521336

A100. *Overview of results from the MST reversed field pinch experiment*, J.S. Sarff, G.F. Abdrashitov, A. Alfier, A.F. Almagri, J.K. Anderson, F. Auriemma, W.F. Bergerson, F. Bonomo, M.T. Borchardt, D.L. Brower, D.R. Burke, K. Caspary, B.E. Chapman, D.J. Clayton, S. Combs, D. Craig H.D. Stephens, V.I. Davydenko, P.P. Deichuli, D.R. Demers, D.J. Den Hartog, W.X. Ding, F. Ebrahimi, A. Falkowski, A. Fassina, G. Fiksel, P. Fimognari, C. Foust, C.B. Forest, P. Franz, J.A. Goetz, M. Gobbin, W. Harris, R.W. Harvey, D.J. Holly, A.A. Ivanov, M.C. Kaufman, J. Ko, J. Koliner, V. Kolmogorov, S. Kumar, J.D. Lee, L. Lin, D. Liu, R. Lorenzini, R.M. Magee, K.J. McCollam, M. McGarry, M.C. Miller, V.V. Mirnov, M.D. Nornberg, P.D. Nonn, S.P. Oliva, E. Parke, P. Piovesan, J.A. Reusch, A. Seltzman, D. Spong, D. Stone, N.V. Stupishin, D. Theucks, V. Tangri, P.W. Terry, T.D. Tharp, J. Waksman, Y.M. Yang, T.F. Yates, and P. Zanca, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, OV/5-3Rb. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node205.htm#45374
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/ov_5-3rb.pdf

A101. *Effects of toroidal geometry and FLR nonlocality of fast ions on tearing modes in the reversed field pinch*, V.V. Mirnov, F. Ebrahimi, C.C. Kim, J.R. King, M.C. Miller, J.A. Reusch, D.D. Schnack, C.R. Sovinec, and T.D. Tharp, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, THS/P5-11. IAEA, Vienna, October 2010

http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node401.htm#79214
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/ths_p5-11.pdf

A102. *Gyrokinetic simulations of temperature gradient instability in the RFP*, V. Tangri, P.W. Terry, R.E. Waltz, and J.S. Sarff, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, THC/P4-26. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node345.htm#70655
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/thc_p4-26.pdf

A103. *Radiofrequency current drive experiments on MST*, J.K. Anderson, A.F. Almagri, D.R. Burke, C.B. Forest, J.A. Goetz, M.C. Kaufman, J.S. Sarff, and A.H. Seltzman, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, EXW/P7-01. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node502.htm#96946
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/exw_p7-01.pdf

A104. *Confinement measurements and MHD simulations of oscillating field current drive in a reversed field pinch*, K.J. McCollam, J.K. Anderson, D.L. Brower, D.J. Den Hartog, W.X. Ding, F. Ebrahimi, J.A. Reusch, J.S. Sarff, H.D. Stephens, and D.R. Stone, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, EXW/P2-06. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node179.htm#39801
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/exw_p2-06.pdf

A105. *Non-collisional ion heating and magnetic turbulence in the RFP*, A.F. Almagri, B.E. Chapman, D.J. Den Hartog, S.T.A. Kumar, R.M. Magee, M.C. Miller, V.V. Mirnov, Y. Ren, J.S. Sarff, P.W. Terry, T.D. Tharp, and D.J. Thuecks, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, EXC/P8-01. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node578.htm#112096
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/exc_p8-01.pdf

A106. *Helical structures and improved confinement in the MST RFP*, B.E. Chapman, W.F. Bergerson, F. Bonomo, D.R. Burke, D.J. Clayton, D.J. Den Hartog, W.X. Ding, C.B. Forest, P. Franz, M. Gobbin, J.A. Goetz, C.C. Hegna, M.C. Kaufman, P. Piovesan, J.A. Reusch, J.S. Sarff, and H.D. Stephens, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, EXC/P5-01. IAEA, Vienna, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node369.htm#73863 // http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/exc_p5-01.pdf

A107. *Fluctuation-induced momentum transport and plasma flows in the MST reversed field pinch*, D.L. Brower, W.X. Ding, L. Lin, T.F. Yates, W.F. Bergerson, A.F. Almagri, D.J. Den Hartog, G. Fiksel, J.A. Reusch, and J.S. Sarff, Proceedings of the 23rd IAEA Fusion Energy Conference, Daejon, EXC/P4-02, October 2010
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/html/node304.htm#63777
http://www-naweb.iaea.org/napc/physics/FEC/FEC2010/papers/exc_p4-02.pdf

A108. *System studies of rf current drive for MST*, J. K. Anderson, D. R. Burke, S. Diem, C. B. Forest, J. A. Goetz, R. W. Harvey, E. R. Hendries, M. C. Kaufman, A. H. Seltzman, M. A.Thomas, AIP Conference Proceedings 1406, 489 (2011) doi:10.1063/1.3665021

A109. *Majority ion heating by neutral beam injection and confinement of fast ions in the Madison Symmetric Torus reversed field pinch*, J. K. Anderson, A. F. Almagri, B. E. Chapman, V. I. Davydenko, P. Deichuli, D. J. Den Hartog, C. B. Forest, G. Fiksel, A. A. Ivanov, D. Liu, M. D. Nornberg, J. S. Sarff,

N. Stupishin, J. Waksman, Trans. of Fusion Sci. Tech. 59:1T, 27 (2011)
doi:10.13182/FST11-A11567

A110. *Magnetic reconstruction of nonaxisymmetric quasi-single-helicity configurations in the Madison Symmetric Torus*, F. Auriemma, P. Zanca, W. F. Bergerson, B. E. Chapman, W. X. Ding, D. L. Brower, P. Franz, P. Innocente, R. Lorenzini, B. Momo, D. Terranova, Plasma Phys. Control. Fusion 53, 105006 (2011)
doi:10.1088/0741-3335/53/10/105006

A111. *Bifurcation to 3D Helical Magnetic Equilibrium in an Axisymmetric Toroidal Device*, W. F. Bergerson, F. Auriemma, B. E. Chapman, W. X. Ding, P. Zanca, D. L. Brower, P. Innocente, L. Lin, R. Lorenzini, E. Martines, B. Momo, J. S. Sarff, D. Terranova, Phys. Rev. Lett. 107, 255001 (2011)
doi:10.1103/PhysRevLett.107.255001

A112. *Advances in Time-Resolved Measurement of Magnetic Field and Electron Temperature in Low-Magnetic-Field Plasmas*, D. J. Den Hartog, J. R. Ambuel, M. T. Borchardt, K. J. Caspary, E. A. Den Hartog, A. F. Falkowski, W. S. Harris, J. Ko, N. A. Pablant, J. A. Reusch, P. E. Robl, H. D. Stephens, H. P. Summers, and Y. M. Yang, Trans. Fusion Sci. Technol. 59, 124 (2011)
doi:10.13182/FST11-A11589

A113. *Programmable power supply for MST's poloidal field*, D. J. Holly, J. R. Adney, K. J. McCollam, and J. C. Morin, M. A. Thomas, Proceedings of the IEEE/NPSS 24th Symposium on Fusion Engineering (SOFE), June 2011
doi:10.1109/SOFE.2011.6052344

A114. *Polarimetry-Interferometry Diagnostic for Measurement of Magnetic and Density Perturbations in the High-Temperature Plasma Core*, L. Lin, W.X. Ding, W.F. Bergerson and D.L. Brower, IEEE Transactions on Plasma Science 39, 2394-2395 (2011)
doi:10.1109/TPS.2011.2158556

A115. *Electron temperature fluctuations during sawtooth events in a reversed-field pinch*, C.P. Kasten, D. J. Den Hartog, H. D. Stephens, C. C. Hegna, J. A. Reusch, Plasma Phys. Control. Fusion 53, 112001 (2011)
doi:10.1088/0741-3335/53/11/112001

A116. *First-order finite-Larmor-radius effects on magnetic tearing in pinch configurations*, J.R. King, C. R. Sovinec, V. Mirnov, Phys. Plasmas 18, 042303 (2011)
doi:10.1063/1.3695346

A117. *Behaviour of carbon and boron impurities in the Madison Symmetric Torus*, S. T. A. Kumar, D. J. Den Hartog, R. M. Magee, G. Fiksel, D. Craig, Plasma Phys. Control. Fusion 53, 032001 (2011)
doi:10.1088/0741-3335/53/3/032001

A118. *Note: Multi-point measurement of $|B|$ in the gas-dynamic trap with a spectral motional Stark effect diagnostic*, A. A. Lizunov, D. J. Den Hartog, A. S. Donin, A. A. Ivanov, and V. V. Prikhodko, Rev. Sci. Instrum. 82, 086105 (2011)
doi:10.1063/1.3624742

A119. *Anisotropic Ion Heating and Tail Generation during Tearing Mode Magnetic Reconnection in a High-Temperature Plasma*, R.M. Magee, D. J. Den Hartog, S. T. A. Kumar, A. F. Almagri, B. E. Chapman, G. Fiksel, V. V. Mirnov, E. D. Mezonlin, J. B. Titus, Phys. Rev. Lett. 107, 065005 (2011)
doi:10.1103/PhysRevLett.107.065005

A120. *Overview of the RFX fusion science program*, P. Martin, J. Adamek, P. Agostinetti, M. Agostini, A. Alfier, C. Angioni, V. Antoni, L. Apolloni, F. Auriemma, O. Barana, S. Barison, M. Baruzzo, P. Bettini, M. Boldrin, T. Bolzonella, D. Bonfiglio, F. Bonomo, A.H. Boozer, M. Brombin, J. Brotankova, A. Buffa, A. Canton, S. Cappello, L. Carraro, R. Cavazzana, M. Cavinato, L. Chacon, G. Chitarin, W.A. Cooper, S. Dal Bello, M. Dalla Palma, R. Delogu, A. De Lorenzi, G. De Masi, J.Q. Dong, M. Drevlak, D.F. Escande, F. Fantini, A. Fassina, F. Fellin, A. Ferro, S. Fiameni, A. Fiorentin, P. Franz, E. Gaio, X. Garbet, E. Gazza, L. Giudicotti, F. Gnesotto, M. Gobbin, L. Grando, S.C. Guo, Y. Hirano, S.P. Hirshman, S. Ide, V. Igochine, Y. In, P. Innocente, S. Kiyama, S.F. Liu, Y.Q. Liu, D. Lopez Bruna, R. Lorenzini, A. Luchetta, G. Manduchi, D.K. Mansfield, G. Marchiori, D. Marcuzzi, L. Marrelli, S. Martini, G. Matsunaga, E. Martines, G. Mazzitelli, K. McCollam, S. Menmuir, F. Milani, B. Momo, M. Moresco, S. Munaretto, L. Novello, M. Okabayashi, S. Ortolani, R. Paccagnella, R. Pasqualotto, M. Pavei, G.V. Perverezev, S. Peruzzo, R. Piovan, P. Piovesan, L. Piron, A. Pizzimenti, N. Pomaro, N. Pomphrey, I. Predebon, M.E. Puiatti, V. Rigato, A. Rizzolo, G. Rostagni, G. Rubinacci, A. Ruzzon, H. Sakakita, R. Sanchez, J.S. Sarff, F. Sattin, A. Scaggion, P. Scarin, W. Schneider, G. Serianni, P. Sonato, E. Spada, A. Soppelsa, S. Spagnolo, M. Spolaore, D.A. Spong, G. Spizzo, M. Takechi, C. Taliercio, D. Terranova, V. Toigo, M. Valisa, M. Veranda, N. Vianello, F. Villone, Z. Wang, R.B. White, D. Yadikin, P. Zaccaria, A. Zamengo, P. Zanca, B. Zaniol, L. Zanotto, E. Zilli, G. Zollino and M. Zuin, Nucl. Fusion 51, 094023 (2011)
doi:10.1088/0029-5515/51/9/094023

A121. *Powered oscillator using ignitron switches*, P. D Nonn, A. P. Blair, K. J. McCollam, J. S. Sarff, D. R. Stone, Rev. Sci. Instrum. 82, 064701 (2011)
doi:10.1063/1.3589266

A122. *Experimental Observation of Anisotropic Magnetic Turbulence in a Reversed Field Pinch Plasma*, Y. Ren, A. F. Almagri, G. Fiksel, S. C. Prager, J. S. Sarff, and P. W. Terry, Phys. Rev. Lett. 107, 195002 (2011)
doi:10.1103/PhysRevLett.107.195002

A123. *Experimental Evidence for a Reduction in Electron Thermal Diffusion due to Trapped Particles*, J.A. Reusch, J. K. Anderson, D. J. Den Hartog, F. Ebrahimi, D. D. Schnack, H. D. Stephens, C. B. Forest, Phys. Rev. Lett. 107, 155002 (2011)
doi:10.1103/PhysRevLett.107.155002

A124. *Electron Bernstein Wave Studies in MST*, A. H. Seltzman, J. K. Anderson, P. D. Nonn, J. X. Kauffold, S. J. Diem, C. B. Forest, Radio Frequency Power in Plasmas, Proceedings of the 19th Topical Conference, AIP Conference Proceedings 1406, 485 (2011)
doi:https://doi.org/10.1063/1.3665020

A125. *A Simple Technique for Increasing the Temperature Range of a Cryogenic Frozen-Gas Pellet Injector for Operation with Various Gases*, K. J. Caspary, B. E. Chapman, S. P. Oliva, and S. T. A. Kumar, Fusion Sci. Technol. 62, 375 (2012)
doi:10.13182/FST12-A15336

A126. *Heavy ion beam probe advances from the first installation of the diagnostic on an RFP (invited)*, D. R. Demers, P. J,. Fimognari, Rev. Sci. Instrum. 83, 10D711 (2012)
doi:10.1063/1.4731758

A127. *Density fluctuation measurements by far-forward collective scattering in the MST reversed-field pinch*, W. X Ding, L. Lin, J. R. Duff, D. L. Brower, J. S. Sarff, Rev. Sci. Instrum. 83, 10E302

(2012)
doi:10.1063/1.4728098

A128. *Time-resolved ion energy distribution measurements using an advanced neutral particle analyzer on the MST reversed-field pinch*, S. Eilerman, J. K. Anderson, J. A. Reusch, D. Liu, G. Fiksel, S. Polosatkin, V. Belykh, Rev. Sci. Instrum. 83, 10D302 (2012)
doi:10.1063/1.4728312

A129. *First-order finite-Larmor-radius fluid modeling of tearing and relaxation in a plasma pinch*, J. R. King, Sovinec, C. R. and Mirnov, V. V., Phys. Plasmas 19, 055905 (2012)
doi:10.1063/1.3695346

A130. *Improved spectral analysis for the motional Stark effect diagnostic*, J. Ko, J. Klabacha, Rev. Sci. Instrum. 83, 10D513 (2012)
doi:10.1063/1.4733546

A131. *Fast-Particle-Driven Alfvènic Modes in a Reversed Field Pinch*, J. J. Koliner, C. B. Forest, J. S. Sarff, J. K. Anderson, D. Liu, M. D. Nornberg, J. Waksman, L. Lin, D. L.Brower, W. X. Ding, D. A. Spong, Phys. Rev. Lett. 109, 115003 (2012)
doi:10.1103/PhysRevLett.109.115003

A132. *High resolution charge-exchange spectroscopic measurements of aluminum impurity ions in a high temperature plasma*, S. T. A. Kumar, D. J. Den Hartog, B. E. Chapman, M. O'Mullane, M. Nornberg, D. Craig, S. Eilerman, G. Fiksel, E. Parke and J. Reusch, Plasma Phys. Control. Fusion 54, 012002 (2012)
doi:10.1088/0741-3335/54/1/012002

A133. *Classical impurity ion confinement in a toroidal magnetized fusion plasma*, S. T. A. Kumar, D. J. Den Hartog, K. J. Caspary, R. M. Magee, V. V. Mirnov, B. E. Chapman, D. Craig, G. Fiksel, J. S. Sarff, Phys. Rev. Lett. 108, 125006 (2012)
doi:10.1103/PhysRevLett.108.125006

A134. *Classical confinement and outward convection of impurity ions in the MST RFP*, S. T. A. Kumar, D. J. Den Hartog, V. V. Mirnov, K. J. Caspary, R. M. Magee, D. L. Brower, B. E. Chapman, D. Craig, W. X. Ding, S. Eilerman, G. Fiksel, L. Lin, M. Nornberg, E. Parke, J. A. Reusch, J. S. Sarff, Phys. Plasmas 19, 056121 (2012)
doi:10.1063/1.4718310

A135. *Role of Nonlinear Coupling and Density Fluctuations in Magnetic-Fluctuation-Induced Particle Transport*, L. Lin, W. X. Ding, D. L. Brower, W. F. Bergerson, T. A. Carter, T. F. Yates, A. F. Almagri, B. E. Chapman, J. S. Sarff, Phys. Rev. Lett. 108, 175001 (2012)
doi:10.1103/PhysRevLett.108.175001

A136. *High-performance double-filter soft x-ray diagnostic for measurement of electron temperature structure and dynamics*, M. B McGarry, P. Franz, D. J. Den Hartog, J. A. Goetz, M. A. Thomas, M. Reyfman, S. T. A. Kumar, Rev. Sci. Instrum. 83, 10E129 (2012)
doi:10.1063/1.4740274

A137. *Improvements to the calibration of the MST Thomson scattering diagnostic*, E. Parke, D. J. Den Hartog, L. A. Morton, H. D. Stephens, C. P. Kasten, J. A. Reusch, W. H. Harris, M. T. Borchardt, A. F. Falkowski, N. C. Hurst, A. Plunkett, J. Goglio, Rev. Sci. Instrum. 83, 10E324 (2012)
doi:10.1063/1.4733566

A138. *Calibration of an advanced neutral particle analyzer for the Madison Symmetric Torus reversed-field pinch*, J. A. Reusch, J. K. Anderson, V. Belykh, S. Eilerman, D. Liu, D. G. Fiksel, S. Polosatkin, Rev. Sci. Instrum. 83, 10D704 (2012)
doi:10.1063/1.4729493

A139. *Colinearity alignment of probe beams in a laser-based Faraday effect diagnostic*, L. Lin, W. X. Ding, D. L. Brower, Rev. Sci. Instrum. 83, 10E320 (2012)
doi:10.1063/1.4733541

A140. *The sheared-flow stabilized Z-pinch*, U. Shumlak, J. Chadney, R. P. Golingo, D. J. Den Hartog, M. C. Hughes, S. D. Knecht, W. Lowrie, V. S. Lukin, B. A. Nelson, R. J. Oberto, J. L. Rohrbach, M. P. Ross, G. V. Vogman, Fusion Sci. Tech. 61:1T, 119 (2012)
doi:10.13182/FST12-A13407

A141. *Dissipation range turbulent cascades in plasmas*, P.W. Terry, A. F. Almagri, G. Fiksel, C. B. Forest, D. R. Hatch, F. Jenko, M. D. Nornberg, S. C. Prager, K. Rahbarnia, Y. Ren and J. S. Sarff, Phys Plasmas 19, 055906 (2012)
doi:10.1063/1.3698309

A142. *Neutral beam heating of a RFP plasma in MST*, J. Waksman, J. K. Anderson, M. D. Nornberg, E. Parke, J. A. Reusch, D. Liu, G. Fiksel, V. I. Davydenko, A. A. Ivanov, N. Stupishin, P. P. Deichuli, H. Sakakita, Phys. Plasmas 19, 122505 (2012)
doi:10.1063/1.4772763

A143. *Coupling of current and flow relaxation in reversed-field pinches due to two-fluid effects*, C. Sovinec, J. King, J. Sauppe, V. Mirnov, J. Sarff, and W. Ding, Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, TH/P3-08. IAEA, Vienna, October 2012
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/html/fec12.htm
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/papers/90_THP308.pdf

A144. *Microtearing mode fluctuations in reversed field pinch*, D. Carmody, P. Terry, Y. Ren, J. Sarff, A. Almagri, M. Pueschel, Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, TH/P2-10. IAEA, Vienna, October 2012
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/html/fec12.htm
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/papers/155_THP210.pdf

A145. *Direct diagnosis and parametric dependence of 3D helical equilibrium in the MST RFP*, B. Chapman, F. Auriemma, W. Bergerson, D. Brower, S. Cappello, D. Den Hartog, W. Ding, P. Franz, S. Kumar, P. Innocente, J. H. Kim, L. Lin, R. Lorenzini, E. Martines, K. McCollam, B. Momo, M. Nornberg, E. Parke, P. Piovesan, M. E. Puiatti, J. Reusch, J. Sarff, M. Spolaore, D. Terranova, P. Terry, and P. Zanca, Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, EX/P6-01. IAEA, Vienna, October 2012
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/html/fec12.htm
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/papers/622_EXP601.pdf

A146. *Classical confinement of impurity ions and NBI-born fast ions in the reversed field pinch*, J. Anderson, A. F. Almagri, K. J. Caspary, B. E. Chapman, V. I. Davydenko D. Craig, D. J. Den Hartog, W. Ding, S. Eilerman, C. B. Forest G. Fiksel, A. Ivanov, J. J. Koliner, S. T. A. Kumar, L. Lin, V. V. Mirnov D. Liu, M. D. Nornberg, S. V. Polosatkin, J. S. Sarff, N. Stupishin, D. A. Spong, and J. Waksman, Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, EX/P3-16. IAEA, Vienna, October 2012

http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/html/fec12.htm
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/papers/208_EXP316.pdf

A147. *Magnetic fluctuation-driven intrinsic flow in a toroidal plasma,* W. X. Ding, L. Lin, D. L. Brower, A. F. Almagri, D. J. Den Hartog, G. Fiksel, and J. Sarff, Proceedings of the 24th IAEA Fusion Energy Conference, San Diego, EX/P3-08. IAEA, Vienna, October 2012
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/html/fec12.htm
http://www-naweb.iaea.org/napc/physics/FEC/FEC2012/papers/136_EXP308.pdf

A148. *Fast ion confinement and stability in a neutral beam injected reversed field pinch*, J.K. Anderson, A. F. Almagri, D. J. Den Hartog, S. Eilerman, C. B. Forest, J. J. Koliner, V. V. Mirnov, L. A. Morton, M. D. Nornberg, E. Parke, J. A. Reusch, J. S. Sarff, J. Waksman, V. Belykh, V. I. Davydenko, A. A. Ivanov, S. V. Polosatkin, Y. A. Tsidulko, L. Lin, D. Liu, G. Fiksel, H. Sakakita, D. A. Spong, and J. Titus, Phys. Plasmas 20, 056102 (2013)
doi:10.1063/1.4801749

A149. *Measurement of energetic-particle-driven core magnetic fluctuations and induced fast-ion transport*, L. Lin, W.X. Ding, D.L. Brower, J.J. Koliner, S. Eilerman, J.A. Reusch, J.K. Anderson, M.D. Nornberg, J.S.Sarff, J. Waksman, D. Liu, Phys. Plasmas 20, 030701 (2013)
doi:10.1063/1.4798397

A150. *Kinetic Stress and Intrinsic Flow in a Toroidal Plasma*, W. X. Ding, L. Lin, D. L. Brower, A. F. Almagri, B. E. Chapman, G. Fiksel, D. J. Den Hartog, and J. S. Sarff, Phys. Rev. Lett. 110, 065008 (2013)
doi:10.1103/PhysRevLett.110.065008

A151. *First gaseous boronization during pulsed discharge cleaning*, J. Ko, D. J. Den Hartog, J. A. Goetz, P. J. Weix, and S. T. Limbach, Journal Nucl. Mat. 432, 146 (2013)
doi:10.1016/j.jnucmat.2012.07.040

A152. *Charge-to-mass-ratio-dependent ion heating during magnetic reconnection in the MST RFP*, S.T.A. Kumar, A. F. Almagri, D. Craig, D. J. Den Hartog, M. D. Nornberg, J. S. Sarff, P. W. Terry, Phys. Plasmas 20, 056501 (2013)
doi:10.1063/1.4804958

A153. *Electron kinetic effects on interferometry and polarimetry in high temperature fusion plasmas*, V.V. Mirnov, D.L. Brower, D.J. Den Hartog, W.X. Ding, J. Duff and E. Parke, Nuc.l Fusion 53, 11305 (2013)
doi:10.1088/0029-5515/53/11/113005

A154. *Detailed modeling of the statistical uncertainty of Thomson scattering measurements*, L.A. Morton, E. Parke, D.J. Den Hartog, J. Instrum. 8, C11003 (2013)
doi:10.1088/1748-0221/8/11/C11003

A155. *Electron Density Measurements in the ITER Fusion Plasma*, Christopher Watts, Victor Udintsev, Philip Andrew, George Vayakis, Michael Van Zeeland, David Brower, Russell Feder, Eugene Mukhin, Sergey Tolstyakov, J. Nucl. Instrum. and Methods in Phys. Res. A 720, (2013)
doi:10.1016/j.nima.2012.12.048

A156. *Overview of results from the MST reversed field pinch experiment*, J.S. Sarff, A.F. Almagri, J.K. Anderson, M. Borchardt, D. Carmody, K. Caspary, B.E. Chapman, D.J. Den Hartog, J. Duff, S.

Eilerman, A. Falkowski, C.B. Forest, J.A. Goetz, D.J. Holly, J.-H. Kim, J. King, J. Ko, J. Koliner, S. Kumar, J.D. Lee, D. Liu, R. Magee, K.J. McCollam, M. McGarry, V.V. Mirnov, M.D. Nornberg, P.D. Nonn, S.P. Oliva, E. Parke, J.A. Reusch, J.P. Sauppe, A. Seltzman, C.R. Sovinec, H. Stephens, D. Stone, D. Theucks, M. Thomas, J. Triana, P.W. Terry, J. Waksman D.L. Brower, W.X. Ding, L. Lin D.R. Demers, P. Fimognari J. Titus S. Cappello, P. Franz, P. Innocente, R. Lorenzini, E. Martines, B. Momo, P. Piovesan, M. Puiatti, M. Spolaore, D. Terranova, P. Zanca V. Belykh, V.I. Davydenko, P. Deichuli, A.A. Ivanov, S. Polosatkin, N.V. Stupishin D. Spong D. Craig R.W. Harvey M. Cianciosa, J.D. Hanson, Nucl. Fusion 53, 104017 (2013)
doi:10.1088/0029-5515/53/10/104017

A157. *Overview of the RFX-mod fusion science programme*, P. Martin, M. E. Puiatti, P. Agostinetti, M. Agostini, J. A. Alonso, V. Antoni, L. Apolloni, F. Auriemma, F. Avino, A. Barbalace, M. Barbisan, T. Barbui, S. Barison, M. Barp, M. Baruzzo, P. Bettini, M. Bigi, R. Bilel, M. Boldrin, T. Bolzonella, D. Bonfiglio, F. Bonomo, M. Brombin, A. Buffa, C. Bustreo, A. Canton, S. Cappello, D. Carralero, L. Carraro, R. Cavazzana, L. Chacon, B. Chapman, G. Chitarin, G. Ciaccio, W. A. Cooper, S. Dal Bello, M. Dalla Palma, R. Delogu, A. De Lorenzi, G. L. Delzanno, G. De Masi, M. De Muri, J. Q. Dong, D. F. Escande, F. Fantini, A. Fasoli, A. Fassina, F. Fellin, A. Ferro, S. Fiameni, J. M. Finn, C. Finotti, A. Fiorentin, N. Fonnesu, J. Framarin, P. Franz, L. Frassinetti, I. Furno, M. Furno Palumbo, E. Gaio, E. Gazza, F. Ghezzi, L. Giudicotti, F. Gnesotto, M. Gobbin, W. A. Gonzales, L. Grando, S. C. Guo, J. D. Hanson, C. Hidalgo, Y. Hirano, S. P. Hirshman, S. Ide, Y. In, P. Innocente, G. L. Jackson, S. Kiyama, S. F. Liu, Y. Q. Liu, D. L‘opez Bruna, R. Lorenzini, T. C. Luce, A. Luchetta, A. Maistrello, G. Manduchi, D. K. Mansfield, G. Marchiori, N. Marconato, D. Marcuzzi, L. Marrelli, S. Martini, G. Matsunaga, E. Martines, G. Mazzitelli, K. McCollam, B. Momo, M. Moresco, S. Munaretto, L. Novello, M. Okabayashi, E. Olofsson, R. Paccagnella, R. Pasqualotto, M. Pavei, S. Peruzzo, A. Pesce, N. Pilan, R. Piovan, P. Piovesan, C. Piron, L. Piron, N. Pomaro, I. Predebon, M. Recchia, V. Rigato, A. Rizzolo, A. L. Roquemore, G. Rostagni, A. Ruzzon, H. Sakakita, R. Sanchez, J. S. Sarff, E. Sartori, F. Sattin, A. Scaggion, P. Scarin, W. Schneider, G. Serianni, P. Sonato, E. Spada, A. Soppelsa, S. Spagnolo, M. Spolaore, D. A. Spong, G. Spizzo, M. Takechi, C. Taliercio, D. Terranova, C. Theiler, V. Toigo, G. L. Trevisan, M. Valente, M. Valisa, P. Veltri, M. Veranda, N. Vianello, F. Villone, Z. R. Wang, R. B. White, X. Y. Xu, P. Zaccaria, A. Zamengo, P. Zanca, B. Zaniol, L. Zanotto, E. Zilli, G. Zollino, and M. Zuin, Nucl. Fusion 53, 104018 (2013)
doi:10.1088/0029-5515/53/10/104018

A158. *Design and Modeling of Nanocrystalline Iron Core Resonant Transformers for Pulsed Power Applications*, A.H. Seltzman, P. D. Nonn, J. K. Anderson, IEEE Trans DIelectrics 20 No. 4, 1153 (2013)
doi:10.1109/TDEI.2013.6571430

A159. *High-repetition-rate pulse-burst laser for Thomson scattering on the MST reversed-field pinch*, W.C. Young, L.A. Morton, E. Parke and D.J. Den Hartog, J. Instrum. 8, C11013 (2013)
doi:10.1088/1748-0221/8/11/C11013

A160. *A polarization-based Thomson scattering technique for burning plasmas*, E. Parke, V.V. Mirnov, D.J. Den Hartog, J. Instrum. 9, C02030 (2014)
doi:10.1088/1748-0221/9/02/C02030

A161. *Statistical analysis of variations in impurity ion heating at reconnection events in the Madison Symmetric Torus*, M.S. Cartolano, D. Craig, D.J. Den Hartog, S.T.A. Kumar, M.D. Nornberg, Phys. Plasmas 21, 012510 (2014)
doi:10.1063/1.4861254

A162. *Effects of pressure gradient on global Alfvèn eigenmodes in Reversed Field Pinch*, Huishan Cai, Guoyong Fu, Liang Lin, D. Y. Liu, Weixing Ding, D. Brower, Y. J. Hu, Phys. Plasmas 21 (2014)
doi:10.1063/1.4866602

A163. *Fast ion confinement in the 3D helical RFP*, J.K. Anderson, W. Capecchi, S. Eilerman, J. Koliner, M. Nornberg, J. Reusch, J. Sarff, L. Lin, Plasma Phy. Control. Fusion 56, 094006 (2014)
doi:10.1088/0741-3335/56/9/094006

A164. *MHD simulation of RF current drive in MST*, E.R. Hendries, J.K. Anderson, S. Diem, C.B. Forest, R.W. Harvey, J.A. Reusch, A.H. Seltzman, C.R. Sovinec, Radio Frequency Power in Plasmas, Proceedings of the 20th Topical Conference, AIP Proceedings 1580, 510 (2014)
doi:10.1063/1.4864600

A165. *Energetic-particle-driven instabilities and induced fast-ion transport in a reversed field pinch* , L. Lin, J. K. Anderson, D. L. Brower, W. Capecchi, W. X. Ding, S. Eilerman, C. B. Forest, J.J. Koliner, D. Liu, M. D. Nornberg, J. Reusch, J. S. Sarff, Phys. Plasmas 21, 056104 (2014)
doi:10.1063/1.4872029

A166. *Simulations of the lower-hybrid antenna in the Madison Symmetric Torus reversed-field pinch*, J. Carlsson, M. Kaufman, J. Goetz, D. Smith, M. Thomas, Plasma Phy. Control. Fusion 56, 055007 (2014)
doi:10.1088/0741-3335/56/5/055007

A167. *Theoretical support for optical diagnostics in burning plasmas*, V.V. Mirnov, D.L. Brower, D.J. Den Hartog, W.X. Ding, J. Duff, E. Parke, USBPO eNews, April 30, 2014, Issue 83
https://www.burningplasma.org/newsandevents/?article=enews&issue=043014

A168. *Impurity transport studies in the Madison Symmetric Torus reversed-field pinch during standard and pulsed poloidal current drive regimes*, T Barbui, L. Carraro, D.J. Den Hartog, S.T.A. Kumar, M.D. Nornberg, Plasma Phys. Control. Fusion 56, 075012 (2014)
doi:10.1088/0741-3335/56/7/075012

A169. *Low energy ion distribution measurements in Madison Symmetric Torus plasmas*, J.B. Titus, E.D. Mezonlin and J.A. Johnson III, Phys. Plasmas 21, 062511 (2014)
doi:10.1063/1.4883645

A170. *Alfvèn modes in the Madison Symmetric Torus*, M. Li, B.N. Breizman, L.J. Zeng, L. Lin, W.X. Ding, D.L. Brower, Phys. Plasmas 21, 082505 (2014)
doi:10.1063/1.4891659

A171. *Erratum: Multipoint Thomson scattering diagnostic for the Madison Symmetric Torus reversed-field pinch [Rev. Sci. Instrum.79, 10E733 (2008)]*, J.A. Reusch, M.T. Borchardt, D.J. Den Hartog, A.F. Falkowski, D.J. Holly, R. O'Connell, H.D. Stephens, Rev. Sci. Instrum. 85, 039902 (2014)
doi:10.1063/1.4867671

A172. *Full particle orbit tracing with the RIO code in the presence of broad-spectrum MHD activity in a reversed-field pinch*, J. A. Reusch, J. K. Anderson, Y. Tsidulko, Nucl. Fusion 54, 104007 (2014)
doi:10.1088/0029-5515/54/10/104007

A173. *Micro- and Macro-Instability, and Large Density and Beta in Improved Confinement MST RFP Plasmas*, B. Chapman, J. Anderson, D. Brower, W. Capecchi, D. Carmody, K. Caspary, S. Combs, D. Den Hartog, W. Ding, J. Duff, F. Ebrahimi, L. Lin, L. Morton, E. Parke, M. J. Pueschel, J. Sarff, P. Terry,

and W. Young, Proceedings of the 25th IAEA Fusion Energy Conference, St. Petersburg, EX/P3-49. IAEA, Vienna, October 2014
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec_sourcebook_online.pdf
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec2014-preprints/667_EXP349.pdf

A174. *Predator-Prey Time Dynamics and Locking Control of Spontaneous Helical States in the RFP*, M. Nornberg, F. Auriemma, D. Brower, M. Cianciosa, B. Chapman, W. Ding, J. Duff, P. Franz, J. Goetz, J. Hanson, D. Den Hartog, D. Holly, P. Innocente, J. Koliner, L. Lin, M. McGarry, L. Morton, S. Munaretto, E. Parke, J. Sarff, D. Terranova, P. Terry, and G. Whelan, Proceedings of the 25th IAEA Fusion Energy Conference, St. Petersburg, EX/P3-50. IAEA, Vienna, October 2014
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec_sourcebook_online.pdf
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec2014-preprints/207_EXP350.pdf

A175. *Attainment of High Electron Poloidal β in Axisymmetric State and Two Routes to Self-Organized Helical State in Low-Aspect-Ratio RFP*, S. Masamune, A. Sanpei, H. Tanaka, K. Nishimura, R. Ueba, G. Ishii, R. Kodera, H. Himura, N. Mizuguchi, K. Ichiguchi, T. Akiyama, K. Kawahata, D. Den Hartog, R. Paccagnella, and H. Koguchi, Proceedings of the 25th IAEA Fusion Energy Conference, St. Petersburg, EX/P3-52. IAEA, Vienna, October 2014
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec_sourcebook_online.pdf
http://www-naweb.iaea.org/napc/physics/FEC/FEC2014/fec2014-preprints/550_EXP352.pdf

A176. *Effect of beryllium filter purity on x-ray emission measurements*, M. B. McGarry, P. Franz, D. J. Den Hartog, and J. A. Goetz, Plasma Phys. Control. Fusion 56, 125018 (2014)
doi:10.1088/0741-3335/56/12/125018

A177. *Note: Effect of photodiode aluminum cathode frame on spectral sensitivity in the soft x-ray energy band*, M. B. McGarry, P. Franz, D. J. Den Hartog, J.A. Goetz, and J. Johnson, Rev. Sci. Instrum. 85, 096105 (2014)
doi:10.1063/1.4894656

A178. *Electron kinetic effects on interferometry, polarimetry and Thomson scattering measurements in burning plasmas*, V. V. Mirnov, D. L. Brower, D. J. Den Hartog, W. X. Ding, J. Duff, and E. Parke, Rev. Sci. Instrum. 85, 11D302 (2014)
doi:10.1063/1.4891176

A179. *An integrated data analysis tool for improving measurements on the MST RFP*, L. M. Reusch, M. E. Galante, P. Franz, J. R. Johnson, M. B. McGarry, H. D. Stephens, and D. J. Den Hartog, Rev. Sci. Instrum. 85, 11D844 (2014)
doi:10.1063/1.4886957

A180. *Operation and beam profiling of an up to 200 kHz pulse-burst laser for Thomson scattering*, W. C. Young and D. J. Den Hartog, Rev. Sci. Instrum. 85, 11D808 (2014)
doi:10.1063/1.4885539

A181. *Design of a retarding potential grid system for a neutral particle analyzer*, J.B. Titus, J. K. Anderson, J. A. Reusch and E. D. Mezonlin, Rev. Sci. Instrum. 85, 11D402 (2014)
doi:10.1063/1.4885496

A182. *Resolving small signal measurements in experimental plasma environments using calibrated subtraction of noise signals*, P.J. Fimognari, D.R. Demers, X. Chen, P.M. Schoch, Rev. Sci. Instrum. 85, 11D849 (2014)
doi:10.1063/1.4891976

A183. *High-Frequency Fluctuation Measurements by Far-Infrared Laser Faraday-effect Polarimetry-Interferometry and Forward Scattering System on MST*, W.X. Ding, L. Lin, J.R. Duff, D.L. Brower, Rev. Sci. Instrum. 85, 11D406 (2014)
doi:10.1063/1.4889909

A184. *2D image of local density and magnetic fluctuations from line-integrated interferometry-polarimetry measurements*, L. Lin, W.X. Ding, D.L. Brower, Rev. Sci. Instrum. 85, 11D403 (2014)
doi:10.1063/1.4884788

A185. *Electron kinetic effects on optical diagnostics in fusion plasmas*, V. V. Mirnov, D. L. Brower, D. J. Den Hartog, W. X. Ding, J. Duff, and E. Parke, AIP Conf. Proc. 1612, 157 (2014)
doi:10.1063/1.4894045

A186. *Alfvèn Modes in Madison Symmetric Torus*, Meng Li, B.N. Breizman, L.J. Zheng, W. X. Ding, L. Lin, D. L. Brower, Phys. Plasmas 21, 082505 (2014)
doi:10.1063/1.4891659

A187. *Overview of results from the MST reversed field pinch experiment*, J. S. Sarff, A. F. Almagri, J. K. Anderson, M. Borchardt, W. Cappechi, D. Carmody, K. Caspary, B. E. Chapman, D. J. Den Hartog, J. Duff, S. Eilerman, A. Falkowski, C. B. Forest, M. Galante, J. A. Goetz, D. J. Holly, J. Koliner, S. Kumar, J. D. Lee, D. Liu, K. J. McCollam, M. McGarry, V. V. Mirnov, L. Morton, S. Munaretto, M. D. Nornberg, P. D. Nonn, S. P. Oliva, E. Parke, M. J. Pueschel, J. A. Reusch, J. Sauppe, A. Seltzman, C. R. Sovinec, D. Stone, D. Theucks, M. Thomas, J. Triana, P. W. Terry, J. Waksman, G. C. Whelan, D. L. Brower, W. X. Ding, L. Lin, D. R. Demers, P. Fimognari, J. Titus, F. Auriemma, S. Cappello, P. Franz, P. Innocente, R. Lorenzini, E. Martines, B. Momo, P. Piovesan, M. Puiatti, M. Spolaore, D. Terranova, P. Zanca, V. I. Davydenko, P. Deichuli, A. A. Ivanov, S. Polosatkin, N. V. Stupishin, D. Spong, D. Craig, H. Stephens, R. W. Harvey, M. Cianciosa, J. D. Hanson, B. N. Breizman, M. Li, and L. J. Zheng, Nucl. Fusion 55, 104006 (2015)
doi:10.1088/0029-5515/55/10/104006

A188. *Runaway of Energetic Test Ions in a Toroidal Plasma*, S. Eilerman, J. K. Anderson, J. S. Sarff, C. B. Forest, J. A. Reusch, M. D. Nornberg and J. Kim, Phys. Plasmas 22, 020702 (2015)
doi:10.1063/1.4907662

A189. *Influence of Energetic Ions on Tearing Modes in a Reversed Field Pinch*, H. Cai, L. Lin, W. Ding, J. K. Anderson and D. L. Brower, Plasma Phys. Control. Fusion 57, 025021 (2015)
doi:10.1088/0741-3335/57/2/025021

A190. *Microturbulence Studies of Pulsed Poloidal Current Drive Discharges in the Reversed Field Pinch*, D. Carmody, M. J. Pueschel, J. K. Anderson and P. W. Terry, Phys. Plasmas 22, 012504 (2015)
doi:10.1063/1.4905709

A191. *Physics and optimization of plasma startup in the RFP*, W. Mao, B. E. Chapman, W. X. Ding, L. Lin, A. F. Almagri, J. K. Anderson, D. J. Den Hartog, J. Duff, J. Ko, S. T. A. Kumar, L. Morton, S. Munaretto, E. Parke, J. A. Reusch, J. S. Sarff, J. Waksman, D. L. Brower, W. Liu, Nucl. Fusion 55, 053004 (2015)
doi:10.1088/0029-5515/55/5/053004

A192. *3D toroidal physics: Testing the boundaries of symmetry breaking*, D.A. Spong, Phys. Plasmas 22, 055602 (2015)
doi:10.1063/1.4921255

A193. *Control of 3D equilibria with resonant magnetic perturbations in MST*, S. Munaretto, B.E. Chapman, D.J. Holly, M.D. Nornberg, R.J. Norval, D.J. Den Hartog, J.A. Goetz, K.J. McCollam, Plasma Phys. Control. Fusion 57, 104004 (2015)
doi:10.1088/0741-3335/57/10/104004

A194. *Determination of Z_{eff} by integrating measurements from x-ray tomography and charge exchange recombination spectroscopy*, M. E. Galante, L. M. Reusch, D. J. Den Hartog, P. Franz, J. R. Johnson, M. B. McGarry, M. D. Nornberg, and H. D. Stephens, Nucl. Fusion 55, 123016 (2015)
doi:10.1088/0029-5515/55/12/123016

A195. *Overview of the RFX-mod contribution to the international Fusion Science Program*, Puiatti, M.E., Dal Bello, S., Marrelli, L., Martin, P., Agostinetti, P., Agostini, M., Antoni, V., Auriemma, F., Barbisan, M., Barbui, T., Baruzzo, M., Battistella, M., Belli, F., Bettini, P., Bigi, M., Bilel, R., Boldrin, M., Bolzonella, T., Bonfiglio, D., Brombin, M., Buffa, A., Canton, A., Cappello, S., Carraro, L., Cavazzana, R., Cester, D., Chacon, L., Chapman, B.E., Chitarin, G., Ciaccio, G., Cooper, W.A., Dalla Palma, M., Deambrosis, S., Delogu, R., De Lorenzi, A., De Masi, G., Dong, J.Q., Escande, D.F., Esposito, B., Fassina, A., Fellin, F., Ferro, A., Finotti, C., Franz, P., Frassinetti, L., Furno Palumbo, M., Gaio, E., Ghezzi, F., Giudicotti, L., Gnesotto, F., Gobbin, M., Gonzales, W.A., Grando, L., Guo, S.C., Hanson, J.D., Hirshman, S.P., Innocente, P., Jackson, J.L., Kiyama, S., Komm, M., Laguardia, L., Li, C., Liu, S.F., Liu, Y.Q., Lorenzini, R., Luce, T.C., Luchetta, A., Maistrello, A., Manduchi, G., Mansfield, D.K., Marchiori, G., Marconato, N., Marocco, D., Marcuzzi, D., Martines, E., Martini, S., Matsunaga, G., Mazzitelli, G., Miorin, E., Momo, B., Moresco, M., Okabayashi, M., Olofsson, E., Paccagnella, R., Patel, N., Pavei, M., Peruzzo, S., Pilan, N., Pigatto, L., Piovan, R., Piovesan, P., Piron, C., Piron, L., Predebon, I., Rea, C., Recchia, M., Rigato, V., Rizzolo, A., Roquemore, A.L., Rostagni, G., Ruset, C., Ruzzon, A., Sajo-Bohus, L., Sakakita, H., Sanchez, R., Sarff, J.S., Sartori, E., Sattin, F., Scaggion, A., Scarin, P., Schmitz, O., Sonato, P., Spada, E., Spagnolo, S., Spolaore, M., Spong, D.A., Spizzo, G., Stevanato, L., Takechi, M., Taliercio, C., Terranova, D., Trevisan, G.L., Urso, G., Valente, M., Valisa, M., Veranda, M., Vianello, N., Viesti, G., Villone, F., Vincenzi, P., Visona, N., Wang, Z.R., White, R.B., Xanthopoulos, P., Xu, X.Y., Yanovskiy, V., Zamengo, A., Zanca, P., Zaniol, B., Zanotto, L., Zilli, E., Zuin, M., Nucl. Fusion 55, 104012 (2015)
doi:10.1088/0029-5515/55/10/104012

A196. *Overview of gyrokinetic studies of finite-β microturbulence*, P.W. Terry, D. Carmody, H. Doerk, W. Guttenfelder, D.R. Hatch, C.C. Hegna, A. Ishizawa, F. Jenko, W.M. Nevins, I. Predebon, M.J. Pueschel, J.S. Sarff and G.G. Whelan, Nucl. Fusion 55, 104011 (2015)
doi:10.1088/0029-5515/55/10/104011

A197. *Thomson scattering at 250 kHz*, W. C. Young and D. J. Den Hartog, JINST 10, C12021 (2015)
doi:10.1088/1748-0221/10/12/C12021

A198. *A flexible master oscillator for a pulse-burst laser system*, D. J. Den Hartog and W. C. Young, JINST 10, C12008 (2015)
doi:10.1088/1748-0221/10/12/C12008

A199. *A high time resolution x-ray diagnostic on the Madison Symmetric Torus*, Ami M. DuBois, John David Lee, and Abdulgadar F. Almagri, Rev. Sci. Instrum. 86, 073512 (2015)
doi:10.1063/1.4927454

A200. *Three dimensional equilibrium solutions for a current-carrying reversed-field pinch plasma with a close-fitting conducting shell*, J. J. Koliner, M. R. Cianciosa, J. Boguski, J. K. Anderson, J. D. Hanson,

B. E. Chapman, D. L. Brower, D. J. Den Hartog, W. X. Ding, J. R. Duff, J. A. Goetz, M. McGarry, L. A. Morton, and E. Parke, Phys. Plasmas 23, 032508 (2016)
doi:https://doi.org/10.1063/1.4944670

A201. *Current profile redistribution driven by neutral beam injection in a reversed-field pinch*, E. Parke, J. K. Anderson, D. L. Brower, D. J. Den Hartog, W. X. Ding, C. A. Johnson, and L. Lin, Phys. Plasmas 23, 056108 (2016)
doi:10.1063/1.4946019

A202. *Exact relativistic expressions for polarization of incoherent Thomson scattering*, V. V. Mirnov, D. J. Den Hartog, and E. Parke, Phys. Plasmas 23, 052108 (2016)
doi:https://doi.org/10.1063/1.4948488

A203. *Identification of island-induced Alfvèn eigenmodes in a reversed field pinch*, C. R. Cook, C. C. Hegna, J. K. Anderson, K. J. McCollam, J. Boguski, R. Feng, J. J. Koliner, D. A. Spong, S. P. Hirshman, Plasma Phys. Control. Fusion 58, 054004 (2016)
doi:10.1088/0741-3335/58/5/054004

A204. *Absolute wavelength calibration of a Doppler spectrometer with a custom Fabry-Perot optical system*, M. M. Baltzer, D. Craig, D. J. Den Hartog, T. Nishizawa, and M. D. Nornberg, Rev. Sci. Instrum. 87, 11E509 (2016)
doi:10.1063/1.4955491

A205. *A comparison between soft x-ray and magnetic phase data on the Madison symmetric torus*, P. D. VanMeter, P. Franz, L. M. Reusch, J. S. Sarff, and D. J. Den Hartog, Rev. Sci. Instrum. 87, 11E322 (2016)
doi:10.1063/1.4960492

A206. *Calibration of a two-color soft x-ray diagnostic for electron temperature measurement*, L. M. Reusch, D. J. Den Hartog, P. Franz, J. Goetz, M. B. McGarry, and H. D. Stephens, Rev. Sci. Instrum. 87, 11E332 (2016)
doi:10.1063/1.4961281

A207. *Upgrading a high-throughput spectrometer for high-frequency (<400 kHz) measurements*, T. Nishizawa, M. D. Nornberg, D. J. Den Hartog, and D. Craig, Rev. Sci. Instrum. 87, 11E530 (2016)
doi:10.1063/1.4960073

A208. *Spectroscopic determination of the composition of a 50 kV hydrogen diagnostic neutral beam*, X. Feng, M. D. Nornberg, D. Craig, D. J. Den Hartog, and S. P. Oliva, Rev. Sci. Instrum. 87, 11E543 (2016)
doi:10.1063/1.4961269

A209. *Upgrades to improve the usability, reliability, and spectral range of the MST Thomson scattering diagnostic*, S. Z. Kubala, M. T. Borchardt, D. J. Den Hartog, D. J. Holly, C. M. Jacobson, L. A. Morton, and W. C. Young, Rev. Sci. Instrum. 87, 11E547 (2016)
doi:10.1063/1.4962251

A210. *Identification and mitigation of stray laser light in the Thomson scattering system on the Madison Symmetric Torus (MST)*, C. M. Jacobson, M. T. Borchardt, D. J. Den Hartog, A. F. Falkowski, L. A. Morton, and M. A. Thomas, Rev. Sci. Instrum. 87, 11E511 (2016)
doi:10.1063/1.4960063

A211. *A collimated neutron detector for RFP plasmas in MST*, Capecchi, W. J., Anderson, J.K., Bonofiglo, P.J., and Sears, S., Rev. Sci. Instrum. 87, 11D826 (2016)
doi:10.1063/1.4961304

A212. *Analysis Techniques for Diagnosing Runaway Ion Distributions in the Reversed Field Pinch*, J. Kim J. K. Anderson, W. Capecchi, P. J. Bonofiglo and S. H. Sears, Rev. Sci. Instrum. 87, 11D819 (2016)
doi:10.1063/1.4960422

A213. *Development Toward a Fast Ion Loss Detector for the Reversed Field Pinch*, P. J. Bonofiglo, J. K. Anderson, A. F. Almagri, J. Kim, J. Clark, W. Capecchi, S. H. Sears and J. Egedal Rev. Sci. Instrum. 87, 11D824 (2016)
doi:10.1063/1.4959950

A214. *X-ray Analysis of Electron Bernstein Wave Heating in MST*, A. H. Seltzman, J. K. Anderson, A. M. DuBois, A. Almagri and C. B. Forest, Rev. Sci. Instrum. 87, 11E329 (2016)
doi:10.1063/1.4960161

A215. *An Upgraded Interferometer-polarimeter System for Broadband Fluctuation Measurements*, E. Parke, W. X. Ding, J. Duff, D. L. Brower, Rev. Sci. Instrum. 87, 11E115 (2016)
doi:10.1063/1.4960731

A216. *Development of a beam ion velocity detector for the heavy ion beam probe*, P.J. Fimognari, T.P. Crowley, D.R. Demers, Rev. Sci. Instrum. 87, 11D414 (2016)
doi:10.1063/1.4959941

A217. *Control of secondary electrons from ion beam impact using a positive potential electrode*, T.P. Crowley, D.R. Demers, P.J. Fimognari, Rev. Sci. Instrum. 87, 11D418 (2016)
doi:10.1063/1.4960170

A218. *Effect of resonant magnetic perturbations on three dimensional equilibria in the Madison Symmetric Torus reversed-field pinch*, S. Munaretto, B.E. Chapman, M.D. Nornberg, J. Boguski, A.M. DuBois, A.F. Almagri, J.S. Sarff, Phys. Plasmas 23, 056104 (2016)
doi:10.1063/1.4943524

A219. *Tearing mode dynamics and locking in the presence of external magnetic perturbations*, R. Fridström, S. Munaretto, L. Frassinetti, B. E. Chapman, P. R. Brunsell, J. S. Sarff, Phys. Plasmas 23, 062504 (2016)
doi:10.1063/1.4953438

A220. *Dynamics of a Reconnection-Driven Runaway Ion Tail in a RFP Plasma*, J. K. Anderson, J. Kim, P. J. Bonofiglo, W. Capecchi, S. Eilerman, M. D. Nornberg, J. S. Sarff and S. H. Sears, Phys. Plasmas 23, 055702 (2016)
doi:10.1063/1.4943525

A221. *Multifield Measurement of Magnetic Fluctuation-Induced Particle Flux in a High-Temperature Toroidal Plasma*, L. Lin, W.X. Ding, D.L. Brower, Nucl. Fusion 56, 126020 (2016)
doi:10.1088/0029-5515/56/12/126020

A222. *Overview of MST Reversed Field Pinch Research in Advancing Fusion Science*, J.S. Sarff, A.F. Almagri, J.K. Anderson, V. Belykh, P.R. Brunsell, J. Boguski, P. Bonofiglo, M. Borchardt, D.L. Brower, W. Cappechi, B.E. Chapman, C. Cook, D. Craig, T. Crowley, J. Egedal, V. Davydenko, D. Demers, D.J. Den Hartog, A. DuBois, J. Duff, W.X. Ding, X. Feng, P. Fimognari, L. Frassinetti, R. Fridström,

C.B. Forest, P. Franz, M. Galante, J.A. Goetz, R.W. Harvey, C.C. Hegna, S.P. Hirshman, D.J. Holly, A. Ivanov, C. Jacobson, J. Johnson, J. Kim, S. Kubala, L. Lin, K.J. McCollam, M. McGarry, V.V. Mirnov, L. Morton, S. Munaretto, T. Nishizawa, M.D. Nornberg, R. Norval, P. Nonn, S. Oliva, E. Parke, S. Polosatkin, M.J. Pueschel, J.A. Reusch, L.M. Reusch, J. Sauppe, O. Schmitz, S. Sears, A. Seltzman, C.R. Sovinec, D. Spong, H. Stephens, M. Tan, D. Thuecks, J. Titus, J. Triana, P.W. Terry, G. Whelan, Z. Williams, A. Xing, Proceedings of the 26th IAEA Fusion Energy Conference, Kyoto, OV/P-5. IAEA, Vienna, October 2016
https://conferences.iaea.org/event/98/contributions/11730/
https://conferences.iaea.org/event/98/contributions/11730/attachments/5879/7249/SarffJ_OV_proceedings.pdf

A223. *Evidence for Trapped Electron Mode Turbulence in MST Improved Confinement RFP Plasmas*, D.L. Brower, J. Duff, Z. Williams, B.E. Chapman, W.X. Ding, L. Lin, E. Parke, M.J. Pueschel, J.S. Sarff, P.W. Terry, Proceedings of the 26th IAEA Fusion Energy Conference, Kyoto, EX/P5-17. IAEA, Vienna, October 2016
https://conferences.iaea.org/event/98/contributions/11862/

A224. *Enhanced measurements for MHD validation using integrated data analysis on the MST fusion research experiment*, D. J. Den Hartog, A. F. Almagri, D. Craig, P. Franz, M. E. Galante, C. M. Jacobson, J. R. Johnson, K. J. McCollam, M. B. McGarry, L. A. Morton, M. D. Nornberg, E. Parke, J. A. Reusch, L. M. Reusch, J. S. Sarff, J. P. Sauppe, C. R. Sovinec, H. D. Stephens, and J. C. Triana, Proceedings of the 26th IAEA Fusion Energy Conference, Kyoto, EXD/P5-6. IAEA, Vienna, October 2016
https://conferences.iaea.org/event/98/contributions/11790/

A225. *An island induced Alfvén eigenmode and effects of nonaxisymmetry on fast ions in the RFP*, J. K. Anderson, J. Boguski, P. Bonofiglo, W. Capecchi, C. R. Cook, C. C. Hegna, J. Kim, K. J. McCollam, J. S. Sarff, S. Sears, V. Belykh, V. I. Davydenko, A. A. Ivanov, S. Polosatkin, S. P. Hirshman, D. Spong and E. Parke, Proceedings of the 26th IAEA Fusion Energy Conference, Kyoto, EX/P5-16. IAEA, Vienna, October 2016
https://conferences.iaea.org/event/98/contributions/11596/

A226. *Role of MHD dynamo in the formation of 3D equilibria in fusion plasmas*, P. Piovesan, D. Bonfiglio, S. Cappello, L. Chacón, C. Chrystal, D.F. Escande, P. Franz, C.T. Holcomb, V. Igochine, T.C. Luce, L. Marrelli, M.D. Nornberg, C. Paz-Soldan, L. Piron, J.S. Sarff, N.Z. Taylor, D. Terranova, F. Turco, R.S. Wilcox, A. Wingen, P. Zanca, B. Zaniol, the RFX-mod Team, the MST Team, the DIII-D Team, the ASDEX Upgrade Team, and the EUROfusion MST Team, Proceedings of the 26th IAEA Fusion Energy Conference, Kyoto, EX/1-1. IAEA, Vienna, October 2016
https://conferences.iaea.org/event/98/contributions/11565/

A227. *Preferential confinement and field-aligned acceleration of energetic ions in a reversed field pinch*, Anderson, J. K. and Kim, J. and Sarff, J. S. and Belykh, V. and Davydenko, V. I. and Ivanov, A. A. and Polosatkin, S., AIP Conference Proceedings, 1771, 040001 (2016)
doi:10.1063/1.4964186

A228. *Electron thermal confinement in a partially chaotic magnetic island*, L. A. Morton, W. C. Young, D. J. Den Hartog, C. C. Hegna, E. Parke, J. A. Reusch, Phys. Plasmas 25, 042306 (2018)
doi:10.1063/1.5021893

A229. *A pulse-burst laser system for Thomson scattering on NSTX-U*, D.J. Den Hartog, M.T. Borchardt, D.J. Holly, A. Diallo and B. LeBlanc, JINST 12, C10002 (2017)
doi:10.1088/1748-0221/12/10/C10002

A230. *Anisotropic Electron Tail Generation during Tearing Mode Magnetic Reconnection*, A.M. DuBois, A.F. Almagri, J.K. Anderson, D.J. Den Hartog, J.D. Lee, J.S. Sarff, Phys. Rev. Lett. 118, 075001 (2017)
doi:10.1103/PhysRevLett.118.075001

A231. *Polarization of incoherent Thomson scattering for electron temperature measurement*, V.V. Mirnov, D.J. Den Hartog, Plasma Phys. Control. Fusion 59, 063001 (2017)
doi:10.1088/1361-6587/aa61e2

A232. *Linearized spectrum correlation analysis for line emission measurements*, T. Nishizawa, M. D. Nornberg, D. J. Den Hartog, and J. S. Sarff, Rev. Sci Instr. 88, 083513 (2017)
doi:10.1063/1.4999450

A233. *Observation of Electron Bernstein Wave Heating in the RFP*, A.H. Seltzman, J. K. Anderson, S. J. Diem , J. A. Goetz, C. B. Forest, Phys. Rev. Lett. 119, 185001 (2017)
doi:https://doi.org/10.1103/PhysRevLett.119.185001

A234. *A multi-channel capacitive probe for electrostatic fluctuation measurement in the Madison Symmetric Torus reversed field pinch*, M. Tan, D.R. Stone, J. C. Triana, A. F. Almagri, G. Fiksel, W. Ding, J. S. Sarff, K. J. McCollam, H. Li, and W. Liu, Rev Sci Instr 88, 023502 (2017)
doi:10.1063/1.4975095

A235. *Evidence for drift waves in the turbulence of reversed field pinch plasmas*, D.J. Thuecks, A. F. Almagri, J. S. Sarff, and P. W. Terry, Phys Plas 24, 022309 (2017)
doi:10.1063/1.4976838

A236. *Observation of trapped-electron-mode microturbulence in reversed field pinch plasmas*, J.R. Duff, Z. R. Williams, D. L. Brower, B. E. Chapman, W. X. Ding, M. J. Pueschel, J. S. Sarff, and P. W. Terry, Phys. Plasmas 25, 10701 (2018)
doi:10.1063/1.5010198

A237. *Simulation, design, and first test of a multi-energy soft x-ray (SXR) pinhole camera in the Madison Symmetric Torus (MST)*, L.F. Delgado-Aparicio, J. Wallace, H. Yamazaki, P. VanMeter, L. Reusch, M. Nornberg, A. Almagari, J. Maddox, B. Luethi, M. Rissi, T. Donath, D. Den Hartog, J. Sarff, P. Weix, J. Goetz, N. Pablant, K. Hill, B. Stratton, P. Efthimion, Y. Takase, A. Ejiri, and M. Ono, Rev. Sci. Instrum 89, 10G116 (2018)
doi:10.1063/1.5038798

A238. *Turbulence-driven anisotropic electron tail generation during magnetic reconnection*, A.M. DuBois, A. Scherer, A. F. Almagri, J. K. Anderson, M. D. Pandya, and J. S. Sarff, Phys. Plasmas 25, 055705 (2018)
doi:10.1063/1.5016240

A239. *Dependence of Perpendicular Viscosity on Magnetic Fluctuations in a Stochastic Topology*, R. Fridström, B. E. Chapman,A. F. Almagri,L. Frassinetti,P. R. Brunsell,T. Nishizawa and J. S. Sarff, Phys. Rev. Lett 120, 225002 (2018)
doi:10.1103/PhysRevLett.120.225002

A240. *Measuring dynamic fast ion spatial profiles with fusion protons in the Madison Symmetric Torus*, R.M. Magee , J.K. Anderson, S. Korepanov, L. Frausto, J. Boguski, P.J. Bonofiglo, J. Kim and R. McConnell , Rev. Sci. Instrum. 89, 10L104 (2018)
doi:10.1063/1.5037349

A241. *Relativistic electron kinetic effects on laser diagnostics in burning plasmas*, V.V. Mirnov, D.J. Den Hartog, JINST 13, C02009 (2018)
doi:10.1088/1748-0221/13/02/C02009

A242. *Electron thermal confinement in a partially stochastic magnetic structure*, L.A. Morton, W. C. Young, C.C. Hegna, E. Parke, J.A. Reusch, D.J. Den Hartog, Phys. Plasmas 25, 042306 (2018)
doi:10.1063/1.5021893

A243. *Development of a multi-channel capacitive probe for electric field measurements with fine spatial and high time resolution*, T. Nishizawa, A. F. Almagri, W. Goodman, S. Ohshima, and J. S. Sarff, Rev, Sci. Instrum. 89, 10J118 (2018)
doi:10.1063/1.5035093

A244. *Measurements of Impurity Transport Due to Drift-Wave Turbulence in a Toroidal Plasma*, T. Nishizawa, M.D. Nornberg, J. Boguski, D.J. Den Hartog, J.S. Sarff, Z.R. Williams, Z.A. Xin, Phys. Rev. Lett. 121, 165002 (2018)
doi:10.1103/PhysRevLett.121.165002

A245. *Using integrated data analysis to extend measurement capability (invited)*, L.M. Reusch, M. D. Nornberg, J. A. Goetz, and D. J. Den Hartog, Rev. Sci. Instrum. 89, 10K103 (2018)
doi:10.1063/1.5039349

A246. *Incorporating Beam Attenuation Calculations into an Integrated Data Analysis Model for Ion Effective Charge*, M.D. Nornberg, D.J. Den Hartog, L.M. Reusch, Fusion Sci. Tech., (2018)
doi:10.1080/15361055.2017.1387008

A247. *Model Validation for Quantitative X-Ray Measurements*, L.M. Reusch, P. Franz, D. J. Den Hartog, J. A. Goetz, M. D. Nornberg, and P. VanMeter, Fusion Sci. and Tech. 74:1-2, 167 (2018)
doi:10.1080/15361055.2017.1404340

A248. *Pixel-to-pixel variation on a calibrated PILATUS3-based multi-energy soft x-ray detector*, P. VanMeter, L. F. Delgado-Aparicio, L. Reusch, N. Pablant, J. Maddox, M. Rissi, B. Luethi, T. Donath, C. Schulze-Briese, K. Hill, and D. Den Hartog, Rev. Sci. Instrum 89, 10G119 (2018)
doi:10.1063/1.5037347

A249. *Noise mitigation methods for ion detectors operating with a direct view of high temperature plasmas*, P.J. Fimognari, T.P. Crowley, D.R. Demers, T.D. Kile, Rev. Sci. Instrum. 89, 10I108 (2018)
doi:10.1063/1.5039348

A250. *Fast ion transport in the three-dimensional reversed field pinch*, P.J. Bonofiglo, J.K. Anderson, J. Boguski, J. Kim, J. Egedal, M. Gobbin, D.A. Spong and E. Parke, Phys. Rev. Lett. 123, 055001 (2019)
doi:10.1103/PhysRevLett.123.055001

A251. *Fast ion transport in the quasi-single helical reversed-field pinch*, P.J. Bonofiglo, J.K. Anderson, M. Gobbin, D.A. Spong, J. Boguski, E. Parke, J. Kim, and J. Egedal, Phys. Plasmas 26, 022502 (2019)
doi:10.1063/1.5084059

A252. *Intrinsic flow and tearing mode rotation in the RFP during improved confinement*, D. Craig, E. Tan, B. Schott, J. K. Anderson, J. Boguski, D. J. Den Hartog, T. Nishizawa, M. D. Nornberg, and Z. A. Xing, Phys. Plas. 26, 072503 (2019)
doi:10.1063/1.5095620

A253. *Effects of oscillating poloidal current drive on magnetic relaxation in the MST reversed-field pinch*, Z Li, K. J. McCollam, T. Nishizawa, E. Parke, J. S. Sarff, Z. A. Xing, H. Li, W. Liu, W. Ding, Plasma Phys. Control. Fusion 61, 045004 (2019)
doi:10.1088/1361-6587/aaf9e0

A254. *Direct Measurement of a Toroidally Directed Zonal Flow in a Toroidal Plasma*, T. Nishizawa, A. F. Almagri, Z. R. Williams, J. S. Sarff, M. D. Nornberg, J. K. Anderson, et al., Phys. Rev. Lett. 122, 105001 (2019)
doi:10.1103/PhysRevLett.122.105001

A255. *A measure of fast ion beta at marginal stability in the reversed field pinch*, W. Capecchi, J. K. Anderson, P. Bonofiglo, J. Kim, R. M Magee, K. J. McCollam, R. McConnell, E. Parke, J. S. Sarff, Nucl. Fusion 59, 086026 (2019)
doi:10.1088/1741-4326/ab2473

A256. *Generation and suppression of runaway electrons in MST tokamak plasmas*, S. Munaretto, B. Chapman, B. Cornille, A. DuBois, K. McCollam, C. Sovinec, A. Almagri, J. Goetz, Nucl. Fusion 60, 046024 (2020)
doi:10.1088/1741-4326/ab73c0

A257. *Direct measurements of the 3D plasma velocity in Single-Helical-Axis RFP plasmas*, J. Boguski, M.D. Nornberg, A.F. Almagri, D. Craig, U. Gupta, K.M. McCollam, T. Nishizawa, J.S. Sarff, C.R. Sovinec, P.W. Terry, Z.A. Xing, submitted to Physics of Plasmas, 2020.

A.2 Presentations at Seminars, Conferences, and Workshops

1. Daniel Den Hartog, *Bringing a Star to Earth: Confining and Understanding a High-Temperature Plasma*, Lawrence University, Appleton, Wisconsin, Jan. 2005.
2. John Sarff, *Remnant Magnetic Fluctuations and Transport in the Dynamo-Free*, Plasma Science and Fusion Center, Massachusetts Institute of Technology, Jan. 2005.
3. Stewart Prager, *Magnetic fusion energy science: challenges and opportunities*, Symposium on Fusion Energy, American Association for the Advancement of Science, Annual Conference, Washington, DC., Feb. 2005.
4. Stewart Prager, *Report of the FESAC priorities panel*, Fusion Energy Sciences Advisory Committee meeting, DOE, Washington, DC, Mar. 2005.
5. Stewart Prager, *Reconnection and ion heating in a laboratory plasma*, US-Japan Workshop on Astrophysical Reconnection and Particle Acceleration, Awaji Island, Japan, Mar. 2005.
6. Darren Craig, *Driven and Spontaneous Reconnection in MST*, General Meeting of the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, San Diego, Mar. 2005.
7. Daniel Den Hartog, *Stochastic Magnetic Transport in the MST RFP*, General Meeting of the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, San Diego, Mar. 2005.

8. Darren Craig, *Reconnection and Transport in MST*, Easter Meeting on Stability and Confinement of Magnetized Plasmas, Turin, Italy, Apr. 2005.
9. John Sarff, *Electron Heat Transport in a Stochastic Magnetic Field*, Transport Task Force Meeting, Napa, CA, Apr. 2005.
10. David Brower, *Measurement of Current Density Profile Dynamics and Internal Magnetic Field Fluctuations in a High- Temperature Plasma*, Southwest Institute of Physics, Chengdu, China, May 2005.
11. Daniel Den Hartog, *Fusion Research at UW-Madison: Confining and Understanding High-Temperature Plasmas*, The Ohio State University, Columbus, Ohio, May 2005.
12. John Sarff, *Statistical Properties of Broadband Magnetic Turbulence in the Reversed Field Pinch*, CMSO Workshop on Magnetic Turbulence, University of Wisconsin, Madison, Jun. 2005.
13. Gennady Fiksel, *Ion Heating in the MST Plasma Experiment*, 8th IPELS Meeting, Tromso, Norway, Jul. 2005.
14. Stewart Prager, *Examples of cross-fertilization research being carried out in the Center for Magnetic Self-Organization*, 8th IPELS Meeting, Tromso, Norway, Jul. 2005.
15. John Sarff, *Line-Tied Kink Instability in a Laboratory Plasma*, General Meeting of the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, PPPL, Oct. 2005.
16. Darren Craig, *Experimental Tests of Two-Fluid Relaxation*, General Meeting of the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, PPPL, Oct. 2005.
17. Darren Craig, *Measurement of Hall Effects During Reconnection in the Madison Symmetric Torus*, Fall American Geophysical Union Meeting, San Francisco, CA, 2005.
18. Karsten McCollam, *Oscillating Field Current Drive in the Madison Symmetric Torus*, 47th Annual Meeting of the APS Division of Plasma Physics, Denver, Oct. 2005.
19. Gennady Fiksel, *Confinement of Fast Ions in a Stochastic Magnetic Field*, 47th Annual Meeting of the APS Division of Plasma Physics, Denver, Oct. 2005.
20. Rob O'Connell, *Overview of MHD Control in MST*, 10th Workshop on Active Control of MHD Stability, Madison, Nov. 2005.
21. John Sarff, *Innovative Confinement Concepts Connections to a Burning Plasma Experiment*, MHD Working Group, National Workshop on Burning Plasma Science, Oak Ridge National Laboratory, Dec. 2005.
22. Karsten McCollam, *Overview of Current Research at MST*, seminar, University of Washington, Seattle, Dec. 2005.
23. Stewart Prager, *Magnetic Reconnection*, Winter School on Magnetic Reconnection, UCLA, Jan. 2006.
24. John Sarff, *Remnant Stochastic Transport in the Dynamo-Free RFP*, US-Japan MHD Workshop, in conjunction with 7th Meeting of the ITPA MHD Working Group, Naka Fusion Research Institute (JAEA), Naka, Japan, Feb. 2006.
25. Darren Craig, *Overview of Physics Advances in MST*, Innovative Confinement Concepts Workshop, University of Texas, Austin, Feb. 2006.

26. John Sarff, *Oscillating Field Current Drive on MST*, Innovative Confinement Concepts Workshop, University of Texas, Austin, Feb. 2006.
27. John Sarff, *Line-Tied Kink Instability in the Rotating Wall Machine*, CMSO Meeting on Line-Tied Magnetic Reconnection, Los Alamos National Laboratory, Mar. 2006.
28. Darren Craig, *Ion Heating During Reconnection Events in MST*, April Meeting of the APS, Dallas, TX, Apr. 2006.
29. Jay Anderson, *Experimental Plasma Physics in Fusion Energy Research*, Physics Department, St. Thomas College, St. Paul, MN, Apr. 2006.
30. John Sarff, *Oscillating Field Current Drive on MST*, Conzorzio RFX, Padova, Italy, Apr. 2006.
31. Darren Craig, *Ion Confinement and Heating in the MST Reversed Field Pinch*, EPS Conference on Controlled Fusion and Plasma Physics, Rome, Italy, 2006.
32. Daniel Den Hartog, *Advances in neutral-beam-based diagnostics on the Madison Symmetric Torus reversed-field pinch*, 16th Annual Conference on High-Temperature Plasma Diagnostics, Williamsburg, 2006.
33. Brett Chapman, *Improved confinement MST RFP plasmas with hot ions and high density*, 48th Annual Meeting of the APS Division of Plasma Physics, Philadelphia, Oct. 2006.
34. Daniel Den Hartog, *Overview of Results in the MST Reversed-Field Pinch Experiment*, Twenty-first IAEA Fusion Energy Conference, Chengdu, China, Oct. 2006.
35. David Brower, *Magnetic Flustution-Induced Particle Transport and Zonal Flow Generation in MST*, 11th Joint EU-US Transport Task Force Workshop, Marseille, France, Sep. 2006.
36. Daniel Den Hartog, *CXRS/MSE/BES on the MST Reversed-Field Pinch*, ADAS Workshop, Abingdon, England, Nov. 2006.
37. Stewart Prager, *Turbulence in the Reversed Field Pinch*, Winter School on Turbulence, UCLA, Jan. 2007.
38. Karsten McCollam, *MST Reversed Field Pinch Development*, Current Trends in International Fusion Research: A Review, Washington, DC, Mar. 2007.
39. David Brower, *Magnetic Fluctuation-Induced Particle Transport, Momentum Transport and Flow Generation in MST*, Plasma Science and Fusion Center, Massachusetts Institute of Technology, Boston, May 2007.
40. Darren Craig, *Momentum Transport and Flow Generation from Stochastic Magnetic Fields*, CMSO General Meeting, University of New Hampshire, Jun. 2007.
41. Stewart Prager, *Magnetic self-organization in laboratory and astrophysical plasmas*, First Asian Pacific Symposium on Space, Astrophysical and Laboratory Plasmas, Beijing, China, Jun. 2007.
42. David Brower, *Magnetic Fluctuation-Induced Particle Transport, Momentum Transport and Flow Generation in MST*, Centre de Reserches en Physique des Plasmas, Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland, Jul. 2007.

43. Stewart Prager, *Momentum transport from magnetic fluctuations* and *Magnetic field stochasticity: origin and control*, two review lectures, Summer College on Plasma Physics, International Center for Theoretical Physics, Trieste, Italy, Jul. 2007.

44. Weixing Ding, *Magnetic Fluctuation-Induced Particle and Momentum Transport during Magnetic Reconnection in MST*, 9th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS), Cairns, Australia, Aug. 2007.

45. John Sarff, *Reconnection and Dynamo in the Reversed Field Pinch: MHD and Beyond*, 9th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS), Palm Cove, Cairns, Australia, Aug. 2007.

46. David Brower, *Advanced Interferometry Techniques for Burning Plasmas*, International Conference on Burning Plasma Diagnostics, Varenna, Italy, Sep. 2007.

47. David Brower, *Effects of Stochastic Magnetic Fields on Momentum Transport and Flows during Reconnection* International Workshop on Momentum Transport in Jets, Disks, and Laboratory Plasmas, Alba, Italy, Sep. 2007.

48. David Brower, *Measurements of Stochastic Magnetic Field Driven Particle Transport in MST*, EU-US Transport Task Force Workshop, Copenhagen, Denmark, Sep. 2007.

49. Gennady Fiksel, *Momentum Transport Studies in the MST Reversed Field Pinch*, International Workshop on Momentum Transport in Jets, Disks, and Laboratory Plasmas, Alba, Italy, Sep. 2007.

50. Brett Chapman, *High beta and high temperature plasmas in the MST RFP*, 12th Workshop on MHD Control: Improved MHD Control Configurations, Columbia University, New York, Nov. 2007.

51. Weixing Ding, *Measurements and implications particle and momentum transport from magnetic stochasticity in MST*, 49th Annual Meeting of APS Division of Plasma Physics, Orlando, 2007.

52. Stewart Prager, *Momentum transport from current-driven reconnection*, Mini-conference on Momentum Transport, American Physical Society, Orlando, Nov. 2007.

53. Stewart Prager, *Ion heating from reconnection*, American Geophysical Union Conference, San Francisco, Dec. 2007.

54. Jay Anderson, *Electron Bernstein Wave Research on the Madison Symmetric Torus*, US-Japan Workshop on RF Heating, PPPL, Princeton, Feb. 2008.

55. Stewart Prager, *The effect of reconnection on global and magnetic field flow structures*, Conference on “Magnetic Fields in the Universe,” Cozumel, Mexico, Feb. 2008.

56. Gennady Fiksel, *Ions in the Reversed Field Pinch: Momentum Transport, Heating, and Confinement*, Department of Applied Physics, Columbia University, New York, Apr. 2008.

57. Weixing Ding, *Measurement of Magnetic Fluctuation-induced Particle Flux in MST*, 17th Topical Conference on High-Temperature Plasma Diagnostics, Albuquerque, May 2008.

58. John Sarff, *The MST Reversed Field Pinch Program: Status and Opportunities*, Fourth US-PRC Collaboration Workshop, University of Texas, Austin, May 2008.

59. Stewart Prager, *The reversed field pinch: progress from fusion to astrophysics*, International Seminar on Physics of Accelerators, High Energy Physics and Thermonuclear Research, Budker Institute of Nuclear Physics (commemoration of 50th anniversary of the institute), Novosibirsk, Russia, May 2008.

60. Gennady Fiksel, *Transport of Momentum by Tearing Modes in the MST RFP*, Innovative Confinement Concepts Workshop, University of Nevada, Reno, Jun. 2008.

61. John Sarff, *A Hybrid Inductive Scenario for a Nearly Steady-State Reversed Field Pinch*, Innovative Confinement Concepts Meeting, University of Nevada, Reno, Jun. 2008.

62. David Brower, *Measurements of Stochastic Magnetic Field Driven Particle Transport and Momentum Transport*, Fusion Science Centre, Culham Laboratory, UK, Sep. 2008.

63. John Sarff, *Challenges and Scenarios for Achieving Current Sustainment with Good Confinement in the RFP*, Plasma Physics Seminar, University of Wisconsin-Madison, Sep. 2008.

64. Brett Chapman, *High beta plasmas exceeding dual stability thresholds in the MST RFP*, 22nd IAEA Fusion Energy Conference, Geneva, Switzerland, Oct. 2008.

65. Gennady Fiksel, *Overview of Results in the MST Reversed Field Pinch*, 22nd IAEA Fusion Energy Conference, Geneva, Oct. 2008.

66. Stewart Prager, *Magnetic confinement research*, 50th Annual Meeting of the APS Division of Plasma Physics, Dallas, Nov. 2008.

67. Daniel Den Hartog, *Improved confinement at high current in the MST RFP*, 50th Annual Meeting of the APS Division of Plasma Physics, Dallas, Nov. 2008.

68. Gennady Fiksel, *Transport of Momentum by Tearing Modes in the MST RFP*, 13th Workshop on MHD Stability Control: US-Japan Workshop on MHD Control, Magnetic Islands and Rotation, University of Texas, Austin, Nov. 2008.

69. John Sarff, *Magnetic self-organization in the reversed field pinch*, Physics Department Colloquium, University of Wisconsin-Madison, Jan. 2009.

70. John Sarff, *Heat transport in a stochastic magnetic field*, CMPD and CMSO Winter School 2009, UCLA, Jan. 2009.

71. David Brower, *Magnetic Fluctuation-Induced Particle Transport and Density Relaxation due to Stochastic Magnetic Fields*, Workshop on Stochasticity in Fusion Plasmas, Aachen, Germany, Mar. 2009.

72. Gennady Fiksel, *Ion Heating in Laboratory Plasma*, 2009 APS April Meeting, Denver, May 2009.

73. John Sarff, *Magnetic self-organization in the reversed field pinch*, Physics Department, Florida A&M University, Apr. 2009.

74. Karsten McCollam, *Current Profile Control and Sustainment in the MST Reversed Field Pinch*, 36th EPS Conference on Plasma Physics, Sofia, Bulgaria, Jun. 2009.

75. John Sarff, *Reconnection and dynamo in the reversed field pinch: MHD and beyond*, 9th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS), Palm Cove, Cairns, Australia, Aug. 2009

76. Daniel Den Hartog, *Pulse-burst operation of standard Nd:YAG lasers*, 14th International Symposium on Laser-Aided Plasma Diagnostics, Castelbrando, Treviso, Italy Sep. 2009
77. John Sarff, *The reversed field pinch for fusion-fission hybrid application*, DOE Fusion-Fission Research Needs Workshop (ReNeW), Gaithersburg, MD, Sep. 2009
78. David Brower, *Laser-Based measurement of magnetic fluctuation-induced particle flux in a high-temperature plasma*, 14th Symposium on Laser Aided Plasma Diagnostics, Treviso, Italy, Sep. 2009
79. John Sarff, *Multiple magnetic reconnection regions and magnetic self-organization*, US-Japan Workshop on Magnetic Reconnection, Madison, WI, Oct. 2009
80. Weixing Ding, *Particle transport in a stochastic magnetic field on MST*, 17th International Stellarator/Heliotron Workshop, Princeton, NJ, Oct. 2009
81. Hillary Stephens, *Electron thermal transport within magnetic islands in the RFP*, 51st Annual Meeting of the APS Division of Plasma Physics, Atlanta, GA, Nov. 2009
82. David Brower, *Fluctuation-induced particle transport and density relaxation in a stochastic magnetic field*, 51st Annual Meeting of the APS Division of Plasma Physics, Atlanta, GA, Nov. 2009
83. Gennady Fiksel, *Investigation of ion heating due to reconnection in the MST reversed-field pinch*, 51st Annual Meeting of the APS Division of Plasma Physics, Atlanta, GA, Nov. 2009
84. John Sarff, *Physics progress of reversed field pinch magnetic confinement*, plenary review, 51st Annual Meeting of the APS Division of Plasma Physics, Atlanta, GA, Nov. 2009
85. John Sarff, *Flows and momentum transport in the RFP*, CMPD-CMSO 2010 Winter School on *Shear Flows and Momentum Transport in Lab and Astrophysical Plasmas*, UCLA, Jan. 2010
86. Karsten McCollam, *Oscillating field current drive experiments on MST*, Innovative Confinement Concepts Workshop, Princeton, NJ, Feb. 2010
87. Joshua Reusch, *Varying stochasticity in the core of the MST RFP*, Innovative Confinement Concepts Workshop, Princeton, NJ, Feb. 2010
88. Richard Magee, *Characteristics of non-collisional ion heating in the MST RFP*, Innovative Confinement Concepts Workshop, Princeton, NJ, Feb. 2010
89. Brett Chapman, *Perspectives from U.S. and MST fusion programs*, RFX-mod Programme Planning Workshop, Padova, Italy, Feb. 2010
90. Daniel Den Hartog, *Spectral analysis of polarized light from the motional Stark effect in a high-temperature plasma*, 10th International Colloquium on Atomic Spectra and Oscillator Strengths for Astrophysical and Laboratory Plasmas, Berkeley, CA, Mar. 2010
91. John Sarff, *Taming the energy of stars*, lecture, Edgewood College, Madison, WI, Mar. 2010
92. Liang Lin, *Origin of density fluctuations and particle transport in a stochastic magnetic field*, U.S. Transport Task Force Workshop, Annapolis, MD, Apr. 2010
93. Daniel Den Hartog, *Electron temperature structures associated with magnetic tearing modes in MST*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010

94. Varun Tangri, *Gyrokinetic simulations of ion temperature gradient instability in the RFP*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
95. William Bergerson, *Investigation of QSH conditions in MST with initial data of possible single helicity states*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
96. Cary Forest, *Modeling of Toroidal Alfven Eigenmodes modes in the RFP*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
97. Jay Anderson, *Radio-frequency current-drive experiments in MST*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
98. Karsten McCollam, *Equilibrium evolution, fluctuation and confinement in Oscillating Field Current Drive*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
99. Mark Nornberg, *Initial results from NBI injection in MST*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
100. Abdulgader Almagri, *Non-collisional ion heating and magnetic turbulence in MST*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
101. Weixing Ding, *Electron density fluctuations and particle transport in MST*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
102. Brett Chapman, *Improved confinement in MST associated with PPCD and QSH*, 14th IEA Workshop on Reversed Field Pinch Research, Padova, Italy, Apr. 2010
103. John Sarff, *Highlights of MST in CMSO: connections to astrophysics*, 14th IEA Workshop on Reversed Field Pinch Research, Conzorzio RFX, Padua, Italy, Apr. 2010
104. William Bergerson, *Experimental observations of quasi-single-helicity conditions in the MST RFP*, U.S. Transport Task Force Workshop, Annapolis, MD, Apr. 2010
105. Liang Lin, *Differential interferometry for measurement of density fluctuations and fluctuation-induced transport*, 18th Topical Conference High-Temperature Plasma Diagnostics, Wildwood, NJ, May 2010
106. Daniel Den Hartog, *Pulse-burst laser systems for fast Thomson scattering*, 18th Topical Conference on High-Temperature Plasma Diagnostics, Wildwood, NJ, May 2010
107. Brett Chapman, *Toward understanding and harnessing non-collisional ion heating in the RFP*, 37th EPS Conference on Plasma Physics, Dublin, Ireland, Jun. 2010
108. Jay Anderson, *Studies of Majority Ion Heating by Neutral Beam Injection in MST*, 8th International Conference on Open Magnetic Systems, Novosibirsk, Russia, Jul. 2010
109. Daniel Den Hartog, *Advances in time-resolved measurement of magnetic field and electron temperature in low-magnetic-field plasmas*, 8th International Conference on Open Magnetic Systems, Novosibirsk, Russia, Jul. 2010
110. John Sarff, *Overview of results from the MST reversed field pinch experiment*, 23rd IAEA Conference on Plasma Physics and Controlled Nuclear Fusion, Daejon, Korea, Oct. 2010
111. David Brower, *Application of advanced FIR laser diagnostics on TEXT and toroidal fusion devices*, lecture, Huazhong University of Science and Technology, Wuhan, China, Oct. 2010

112. John Sarff, *Introduction to the RFP*, USTC International Workshop on the RFP, University of Science and Technology of China, Hefei, Oct. 2010
113. Brett Chapman, *Overview of MST*, USTC International Workshop on the RFP, University of Science and Technology of China, Hefei, Oct. 2010
114. Jay Anderson, *Plasma equilibrium and stability in the RFP*, USTC International Workshop on the RFP, University of Science and Technology of China, Hefei, Oct. 2010
115. John Sarff, *RFP development in the ITER era*, USTC International Workshop on the RFP, University of Science and Technology of China, Hefei, Oct. 2010
116. John Sarff, *Physics progress of reversed field pinch magnetic confinement*, seminar, Southwest Institute of Physics, Chengdu, China, Oct. 2010
117. Brett Chapman, *USA Helical structures and improved confinement in the MST RFP*, 15th Workshop on MHD Stability Control & Joint US-Japan Workshop, Madison, WI, Nov. 2010
118. William Bergerson, *Core measurements of 3D effects in quasi-single-helicity plasmas in the MST RFP*, 52nd Annual Meeting of the APS Division of Plasma Physics, Chicago, IL, Nov. 2010
119. Joshua Reusch, *Simulated and measured electron thermal transport with varying magnetic stochasticity in the MST RFP*, 52nd Annual Meeting of the APS Division of Plasma Physics, Chicago, IL, Nov. 2010
120. John Sarff, *Ion heating and confinement in MST*, seminar, Plasma Science and Fusion Center (PSFC), Massachusetts Institute of Technology, Boston, MA, Dec. 2010
121. John Sarff, *Reconnection and ion heating in the MST RFP*, 2010 US-Japan Workshop on Magnetic Reconnection, Nara, Japan, Dec. 2010
122. Brett Chapman, *Operational limits in MST improved-confinement plasmas*, RFX-mod Programme Planning Workshop, Padova, Italy, Feb. 2011
123. William Bergerson, *Core Measurements of 3D effects in quasi-single-helicity plasmas in the MST RFP*, seminar, RFX-mod RFP group, Feb. 2011
124. John Sarff, *Overview of MST and essential RFP physics*, Budker-UW Collaboration Workshop, Novosibirsk, Russia, Mar. 2011
125. Daniel Den Hartog, *Ion energization during magnetic reconnection in MST*, Budker-UW Collaboration Workshop, Novosibirsk, Russia, Mar. 2011
126. John Sarff, *The RFP: Fusion reactor advantages and next steps*, seminar, Budker Institute of Nuclear Physics, Novosibirsk, Russia, Mar. 2011
127. Daniel Den Hartog, *Ion energization during magnetic reconnection in MST RFP*, seminar, Wheaton College, Wheaton, IL, Apr. 2011
128. William Bergerson, *Transition to a helical core equilibrium in a toroidal plasma*, US Transport Task Force Workshop, San Diego, CA, Apr. 2011
129. Weixing Ding, *Effects on momentum transport in a toroidal plasma*, US Transport Task Force Workshop, San Diego, CA. Apr. 2011

130. John Sarff, *Ion heating and confinement in the reversed field pinch*, Physics Department, University of Iowa, Apr. 2011

131. John Sarff, *Taming the energy of stars*, Physics Department seminar, Cornell College, Mt. Vernon, IA, Apr. 2011

132. Daniel Den Hartog, *Confining and Understanding a High-Temperature Plasma: "Bringing a Star to Earth"*, Midwest Magnetic Fields Workshop, Madison, WI, May 2011

133. John Sarff, *Energetic ions in the RFP: creation and confinement*, Kavli Institute for Astronomy and Astrophysics, Beijing University, China, Jun. 2011

134. Kyle Caspary, *Pellet injection into axisymmetric and 3D helical plasmas in the MST RFP*, Joint Innovative Confinement Concepts and US-Japan Compact-Torus Workshop, Seattle, WA, Aug. 2011

135. Joshua Reusch, *Magnetic-diffusion-induced electron transport in the MST RFP*, Joint Innovative Confinement Concepts and US-Japan Compact-Torus Workshop, Seattle, WA, Aug. 2011

136. David Brower, *Intrinsic flow driven by magnetic fluxctuation-driven kinetic stress*, 17th E.U.-U.S. Transport Task Force Workshop, Padova, Italy, Sep. 2012

137. Liang Lin, *Measurements of internal density and magnetic fluctuations in MST-RFP*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

138. Scott Eilerman, *Measurement, modeling, and analysis of the neutral density profile in MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

139. Jay Anderson, *Neutral Beam Heating and Tearing Mode Suppression in MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

140. Brett Chapman, *Helical states, high toroidal field, and high current in MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

141. Kyle Caspary, *Pellet injection experiments on MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

142. Karsten McCollam, *MHD effects with oscillating loop voltages*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

143. Mark Nornberg, *Momentum transport experiments with neutral beam injection on MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

144. Derek Thuecks, *Experimental studies of high-frequency electrostatic and magnetic turbulence in MST*, 15th International Energy Agency RFP Workshop, Madison, WI, Oct. 2011

145. Daniel Den Hartog, *Energetic Ions in the RFP: Creation and Confinement*, 15th International Energy Agency RFP Workshop, Madison, WI Oct. 2011

146. John Sarff, *The reversed field pinch: fusion to astrophysics*, seminar, Astronomy Department, University of Wisconsin, Madison, Nov. 2011

147. Santosh Kumar, *Classical confinement and outward convection of impurity ions in the MST RFP*, 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, UT, Nov. 2011

148. Paul Terry, *Dissipation range turbulent cascades in plasmas*, 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, UT, Nov. 2011
149. John Sarff, *Perspective on reversed field pinch (RFP) fusion research*, Fusion Power Associates, 32nd Annual Meeting and Symposium, Washington DC, Dec. 2011
150. John Sarff, *Self-organization and the quasi-single-helicity regime in RFP plasmas*, CMFTO-CMSO Winter School, UCSD, Jan. 2012
151. John Sarff, *Energetic ions in the RFP: creation, confinement and stability*, US-Japan MHD Workshop Joint with ITPA Topical Group on MHD and Energetic Particles, National Institute for Fusion Studies, Toki, Japan, Mar. 2012
152. David Brower, *Intrinsic flow driven by magnetic fluctuation-driven kinetic stress*, plenary, US Transport Task Force Workshop, Annapolis, MD, Apr. 2012
153. Liang Lin, *Neutral-beam-driven instabilities and their impact on beam ions in a reversed field pinch*, US Transport Task Force Workshop, Annapolis, MD, Apr. 2012
154. Jon Koliner, *Fast particle confinement and Alfvènic instabilities during neutral beam injection on the RFP*, US Transport Task Force Workshop, Annapolis, MD, Apr. 2012
155. John Sarff, *Role of tearing mode harmonics in magnetic relaxation of the RFP*, CMSO Magnetic Reconnection Workshop, Madison, WI, Apr. 2012
156. Diane Demers, *Heavy ion beam probe advances from the first installation of the diagnostic on an RFP*, 19th Topical Conference on High-Temperature Plasma Diagnostics, Monterey, CA, May 2012
157. John Sarff, *Ion heating and acceleration in the reversed field pinch*, US-Japan Workshop on Magnetic Reconnection, Princeton University, May 2012
158. John Sarff, *Highlights from the MST reversed field pinch program*, 6th US-PRC Collaboration Workshop, University of California, San Diego, CA, Jul. 2012
159. Diane Demers, *Overview of Heavy Ion Beam Probe Advances and Methods Enabling Measurements in Tokamaks, Stellarators, and Reversed Field Pinches*, Workshop on Electric Fields, Turbulence and Self-Organization in Magnetized Plasmas, Stockholm, Sweden, Jul. 2012
160. David Brower, *Magnetic fluctuations and fluctuation-induced flux using Faraday effect measurements*, seminar, Culham Centre for Fusion Science, Culham, UK, Sep. 2012
161. Daniel Den Hartog, *The Reversed-Field Pinch: Toroidal Confinement at Low Applied Field*, seminar, National Fusion Research Institute, Daejeon, Korea, Sep. 2012
162. Daniel Den Hartog, *Development of a High Rep Rate Thomson Scattering Diagnostic*, seminar, National Fusion Research Institute, Daejeon, Korea, Sep. 2012
163. John Sarff, *Overview of results from the MST reversed field pinch experiment*, 24th IAEA Conference on Plasma Physics and Controlled Nuclear Fusion, San Diego, CA, Oct. 2012
164. Jay Anderson, *Fast Ion Confinement and Stability in an NBI heated RFP*, 54th Annual Meeting of the APS Division of Plasma Physics, Providence, RI, Oct. 2012

165. Weixing Ding, *Direct evidence of magnetic fluctuation-driven intrinsic flow in a toroidal plasma*, 54th Annual Meeting of the APS Division of Plasma Physics, Providence, RI, Oct. 2012
166. Daniel Den Hartog, *Ion energization during magnetic reconnection in the RFP laboratory plasma*, 54th Annual Meeting of the APS Division of Plasma Physics, Providence, RI, Oct. 2012
167. Jay Anderson, *Fast ion confinement and stability of an NBI-heated RFP*, Plasma Physics Seminar, University of Wisconsin, Madison, WI, Nov. 2012
168. Brett Chapman, *3D equilibria in MST*, 17th Workshop on MHD Stability Control & Joint US-Japan Workshop, New York, NY, Nov. 2012
169. John Sarff, *Ion heating and energization in the RFP*, CMSO Workshop on Particle Energization in Nature and the Laboratory, University of Wisconsin, Madison, Dec. 2012
170. David Brower, *Magnetic-fluctuation-driven intrinsic flow in a toroidal plasma*, seminar, Huazhong University of Science and Technology, Wuhan, China, Jan. 2013
171. David Brower, *Measurements of enegetic-particle-driven instabilities in toroidal devices*, seminar, Huazhong University of Science and Technology, Wuhan, China, Jan. 2013
172. Jay Anderson, *Fast Ions in a Magnetically Confined Fusion Plasma*, Physics Department colloquium, Lawrence University, Appleton, WI Jan. 2013
173. David Brower, *Direct evidence of magnetic fluctuation-driven intrinsic flow in a toroidal plasma*, Workshop on Exploratory Topics in Plasma and Fusion Research, Fort Worth, Texas, Feb. 2013
174. Brett Chapman, *Unified parametric dependence, reconstruction, and control of 3D equilibria in the RFP*, Workshop on Exploratory Plasma Research, Fort Worth, TX, Feb. 2013
175. Karsten McCollam, *Nonlinear dynamics in RFP experiment and computation*, Workshop on Exploratory Plasma Research, Fort Worth, TX, Feb. 2013
176. Jay Anderson, *Saturated fast ion density in the reversed field pinch*, Workshop on Exploratory Topics in Plasma and Fusion Research, Fort Worth, Texas, Feb. 2013
177. Weixing Ding, *Self-generated flow in MST*, U.S.-E.U Joint Transport Task Force Workshop, Santa Rosa, CA, Apr. 2013
178. Liang Lin, *Energetic-particle-driven instabilities and their effects on fast ions in a reversed field pinch*, U.S.-E.U Joint Transport Task Force Workshop, Santa Rosa, CA, Apr. 2013
179. Jon Koliner, *Behavior of Energetic Ions in 3D Fields in a Reversed Field Pinch*, U.S.-E.U Joint Transport Task Force Workshop, Santa Rosa, CA, Apr. 2013
180. John Sarff, *MST and the reversed field pinch*, Plasma Physics Seminar, University of Wisconsin, Madison, May 2013
181. Diane Demers, *The path to exploring physics on ASDEX-U with a Heavy Ion Beam Probe*, seminar, ASDEX-U Group, The Max-Planck-Institute for Plasma Physics, Garching, Germany, May 2013
182. Santhosh Kumar, *Outward convection of impurity ions in the MST RFP*, US-Japan JIFT Meeting, Madison, WI, Jun. 2013

183. Scott Eilerman, *Fast ion confinement and dynamics in the 3D helical RFP*, US-Japan JIFT Meeting, Madison, WI, Jun. 2013
184. Paul Terry, *Suppression of nonlinear interactions in the Quasi Single Helicity State*, US-Japan JIFT Meeting, Madison, WI, Jun. 2013
185. Brett Chapman, *Unified parametric dependence and reconstruction of 3D equilibrium in the RFP*, US-Japan JIFT Meeting, Madison, WI, Jun. 2013
186. Scott Eilerman, *Fast ion confinement and dynamics in the 3D helical RFP*, US-Japan Joint Institute for Fusion Theory (JIFT), Madison, WI, Jun. 2013
187. Mark Nornberg, *Ion energization during magnetic reconnection events in the RFP*, IPELS Workshop, Hakuba, Japan, Jul. 2013
188. Jay Anderson, *Fast Ion Confinement and Effects in the 3D Helical RFP*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
189. Brett Chapman, *Unified parametric dependence, control, and reconstruction of 3D equilibria in the RFP*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
190. Darren Craig, *Ion Heating and Energization in MST*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
191. Chris Hegna, *Theory introduction: Differences and Similarities in the 3D Physics of Stellarator/Heliotrons and Reversed Field Pinches*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
192. Vladimir Mirnov, *Classical Confinement of Impurities in RFP Plasmas*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
193. John Sarff, *Introduction to the RFP*, Joint 19th ISHW and 16th IEA-RFP Workshop, Padua, Italy, Sep. 2013
194. Daniel Den Hartog, *Fusion Science at UW-Madison*, 18th Atomic Processes in Plasmas Conference, Auburn, AL, Oct. 2013
195. Liang Lin, *Laser-based Faraday-effect measurement of magnetic fluctuations and fluctuation-induced transport*, 16th International Symposium Laser Aided Plasma Diagnostics, Madison, WI, Sep. 2013
196. Brett Chapman, *Unified parametric dependence, control, and reconstruction of 3D equilibria in the RFP*, Plasma Physics Seminar, University of Wisconsin, Madison, WI, Nov. 2013
197. Liang Lin, *Energetic-particle-driven instabilities and induced fast-ion transport in a reversed field pinch*, 55th Annual Meeting of the APS Division of Plasma Physics, Denver, CO, Nov. 2013
198. Brett Chapman, *Unified parametric dependence, control, and reconstruction of 3D equilibria in the RFP*, 55th Annual Meeting of the APS Division of Plasma Physics, Denver, CO, Nov. 2013
199. Jon Koliner, *Helical equilibrium physics on MST*, Joint Meeting of US-Japan MHD Workshop and ITPA MHD Stability Group, National Institute for Fusion Studies, Toki, Japan, Mar. 2014
200. Jon Koliner, *Energetic particle-driven instabilities on MST*, Joint Meeting of US-Japan MHD Workshop and ITPA MHD Stability Group, National Institute for Fusion Studies, Toki, Japan, Mar. 2014

201. Jay Anderson, *Alfvèn Waves and Fast Ion Transport in the RFP*, CMSO General Meeting, Santa Fe NM, Mar. 2014

202. Liang Lin, *Energetic-particle-driven instabilities in a reversed field pinch*, US Transport Task Force Workshop, San Antonio, TX, Apr. 2014

203. Brett Chapman, *3D equilibria in the RFP*, seminar, Dept. of Physics and Engineering Physics, University of Saskatchewan, Canada, Apr. 2014

204. John Sarff, *Particle energization associated with tearing mode magnetic reconnection in the reversed field pinch*, US-Japan Workshop on Magnetic Reconnection, Univ. Tokyo, Japan, May 2014

205. Diane Demers, *The Feasibility of Using a Heavy Ion Beam Probe to Measure the Plasma Electric Potential in Large Devices such as ASDEX Upgrade*, Workshop on Electric Fields, Turbulence and Self-Organization in Magnetized Plasmas (EFTSOMP2014), Berlin, Germany, Jun. 2014

206. Stefano Munaretto, *Control and understanding of 3D equilibria in the RFP*, Workshop on Exploratory Topics in Plasma and Fusion Research (EPR) and US-Japan Compact Torus (CT) Workshop, Madison, Aug. 2014

207. Kyle Caspary, *Probing the limits on beta and density in the RFP*, Workshop on Exploratory Topics in Plasma and Fusion Research (EPR) and US-Japan Compact Torus (CT) Workshop, Madison, Aug. 2014

208. Joshua Reusch, *A Direct Comparison of Single-Fluid MHD Simulations to the MST RFP*, Workshop on Exploratory Topics in Plasma and Fusion Research (EPR) and US-Japan Compact Torus (CT) Workshop, Madison, Aug. 2014

209. Matthew Galante, *Determination of Z_{eff} in the Madison Symmetric Torus through Integrated Data Analysis*, Workshop on Exploratory Topics in Plasma and Fusion Research (EPR) and US-Japan Compact Torus (CT) Workshop, Madison, Aug. 2014

210. William Young, *Electron Heating During m=0 Mode Activity on the MST RFP*, Workshop on Exploratory Topics in Plasma and Fusion Research (EPR) and US-Japan Compact Torus (CT) Workshop, Madison, Aug. 2014

211. John Sarff, *MST and the Reversed Field Pinch*, seminar, Applied Physics and Applied Mathematics, Columbia University, NY, Sep. 2014

212. Brett Chapman, *Overview of Results from the MST Reversed Field Pinch Experiment*, 25th IAEA Fusion Energy Conference, St. Petersburg, Russia, Oct. 2014

213. Paul Terry, *Overview of Gyrokinetic Studies on Electromagnetic Turbulence*, 25th IAEA Fusion Energy Conference, St. Petersburg, Russia, Oct. 2014

214. Robert Granetz, *An ITPA Joint Experiment to Study Runaway Electron Generation and Suppression*, IAEA Fusion Energy Conference, St. Petersburg, Russia, Oct. 2014 (included MST data by B. Chapman et al.)

215. Robert Granetz, *Update on MDC-16: Runaway electron generation, confinement, and loss*, 24th ITPA Topical Group Meeting on MHD Disruptions and Control, Padova, Italy, Oct. 2014 (included MST data by B. Chapman et al.)

216. Donald Spong, *Tutorial: 3D toroidal physics – testing the boundaries of symmetry breaking*, 56th Annual Meeting, APS Division of Plasma Physics, New Orleans, Oct. 2014

217. Donald Spong, *Recent progress on simulation of EP instabilities in axisymmetric and 3D configurations*, 2014 US-Japan JIFT Workshop on Progress in Kinetic Plasma Simulations, New Orleans, LA, Nov. 2014

218. Stefano Munaretto, *Control of 3D equilibria with a RMP in MST*, Plasma Physics Seminar, University of Wisconsin, Madison, Nov. 2014

219. Stefano Munaretto, *Control of 3D equilibria with a 3D RMP in MST*, 19th Workshop on MHD Stability Control, Auburn University, AL, Nov. 2014

220. Donald Spong, *Development of gyrofluid and gyrokinetic models for energetic particle instabilities*, JIFT Exchange visit to NIFS, Mar. 2015

221. Robert Granetz, *Update on MDC-16: Runaway electron generation, confinement, and loss*, 25th ITPA Topical Group Meeting on MHD Disruptions and Control, Cadarache, France, Apr. 2015 (included MST data by B. Chapman et al.)

222. James Duff, *Experimental evidence for density gradient driven trapped electron modes in improved confinement RFP plasmas*, US/EU Transport Task Force Workshop, Salem, MA, Apr. 2015

223. William Capecchi, *Energetic Particles physics in MST reversed field pinch*, US/EU Transport Task Force Workshop, Salem, MA, Apr. 2015

224. Zach Williams, *Comparing Recent Experimental Observations in the Reversed-Field Pinch with Gyrokinetic Simulations*, US/EU Transport Task Force Workshop, Salem, MA, Apr. 2015

225. Donald Spong, *3D equilibrium effects on energetic particle instabilities*, US/EU Transport Task Force Workshop, Salem, MA, Apr. 2015

226. Brett Chapman *Opportunities to advance the physics of transients with MST tokamak and RFP plasmas*, Workshop on Transients: Community Input Teleconference, Apr 2015

227. Karsten McCollam *Validating Extended MHD Models for Fusion Plasmas*, Workshop on Integrated Simulations for Magnetic Fusion Energy Sciences (Teleconference), May 2015

228. Daniel Den Hartog *Integrated Data Analysis to Expand Measurement Capability*, Workshop on Integrated Simulations for Magnetic Fusion Energy Sciences (Teleconference), May 2015

229. John Sarff, *Particle Energization via Tearing Instability with Global Self-Organization Constraints*, Plasma Energization: Exchanges Between Fluid and Kinetic Scales, Center for Nonlinear Studies, Los Alamos National Laboratory, May 2015

230. Ami DuBois, *Particle energization associated with tearing mode magnetic reconnection*, Midwest Magnetic Fields Workshop, Madison, May 2015

231. Vladimir Mirnov, *Possibility of Fizeau interferometry in magnetized plasma*, Midwest Magnetic Fields Workshop, Madison, May 2015

232. Joseph Triana, *The Hall Dynamo in a Reversed Field Pinch Plasma* Midwest Magnetic Fields Workshop, Madison, May 2015

233. Lisa Reusch, *Electron Temperature Measurements Combining Soft X-ray Tomography with Thomson Scattering Using MCMC*, 1st IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Nice, France, Jun. 2015

234. Matthew Galante (presented by L.M. Reusch), *Impurity Density Profiles and Their Effect on Zeff by Integrating Measurements from the Soft X-ray Tomography System and Charge Exchange Recombination Spectroscopy*, 1st IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Nice, France, Jun. 2015

235. Karsten McCollam, *Comparing MHD simulations to experiments*, 1st IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Nice, France, Jun. 2015

236. Mark Nornberg, *The Energetics of Self-Organized Plasmas*, Frontiers of Plasma Science Workshops Town Meeting, Bethesda, MD, Jun. 2015

237. John Sarff, *Achieving an Ohmically Heated Plasma for Fusion Energy*, Frontiers of Plasma Science Workshops Town Meeting, Bethesda, MD, Jun. 2015

238. Donald Spong, *Gyrokinetic models for energetic particle instabilities in 3D configurations*, 2015 US-Japan JIFT Workshop, General Atomics, San Diego, Jul. 2015

239. John Finn, *Error field penetration and locking to the backward propagating wave*, Workshop on Theory and Simulations of Disruptions, PPPL, Jul. 2015

240. Lisa Reusch, *Improving electron temperature and Z_{eff} measurements at the Madison Symmetric Torus using Integrated Data Analysis*, remote presentation, Wendelstein Seminar, Max-Planck-Institut für Plasmaphysik, Greifswald, Aug. 2015

241. Ami DuBois, *Particle Heating and Energization Associated with Tearing Mode Reconnection*, 2015 International Workshop on the Interrelationship between Plasma Experiments in the Laboratory and in Space (IPELS), Pitlochry, UK, Aug. 2015

242. William Young, *Thomson Scattering at 250kHz*, 17th International Symposium on Laser-Aided Plasma Diagnostics, Sapporo, Japan, Sep. 2015

243. Donald Spong, *Analysis of energetic particle-driven Alfvèn instabilities in 3D toroidal systems using global gyrokinetic models*, 14th IAEA Technical Meeting on Energetic Particle Physics, Vienna, Austria, Sep. 2015

244. Donald Spong, *Global gyrokinetic analysis of energetic particle-driven Alfvèn instabilities in stellarators*, 20th International Stellarator/Heliotron Workshop, Greifswald, Germany, Oct. 2015

245. Craig Jacobson, *Validation of MHD Models for MST Reversed Field Pinch Plasmas*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

246. Mark Nornberg, *Combining impurity recombination x-ray and impurity density measurements to determine Zeff*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

247. Ami Dubois, *Particle heating and energization associated with tearing mode reconnection*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

248. Joseph Triana, *Coupled Current-Momentum Relaxation in Reversed Field Pinch Plasmas*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

249. Jay Anderson, *Energetic Ion Physics in MST*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

250. John Sarff, *Opportunities and Challenges in RFP Research*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

251. Brett Chapman, *Recent results from MST RFP and tokamak plasmas produced with a programmable power supply*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

252. Brett Chapman, *Probing the density and beta limits with pellet injection and NBI*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

253. Paul Terry, *Thermal transport barrier behavior in a dynamic model for the quasi single helicity state*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

254. Paul Terry, *Gyrokinetic modeling of trapped electron mode turbulence in MST*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

255. Mark Nornberg, *Using resonant magnetic perturbations to control and diagnose QSH plasmas*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

256. Richard Fridström, *Magnetic perturbation effect on tearing mode rotation in MST*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

257. Weixing Ding, *Edge density fluctuation measurements in PPCD plasma*, IEA RFP Workshop, USTC, Hefei, China, Oct. 2015

258. John Sarff, *Particle Energization via Tearing Instability with Global Self-Organization Constraints*, Plasma Physics Seminar, USTC, Hefei, China, Nov. 2015

259. Robert Granetz, *Update on MDC-16: Runaway electron generation, confinement, and loss*, 26th ITPA Topical Group Meeting on MHD, Disruptions and Control, Naples, Italy, Oct. 2015 (included MST data by B. Chapman et al.)

260. Francesco Volpe, *Magnetic Control of Locked Modes in Present Devices and ITER (WG-11)*, 26th ITPA Topical Group Meeting on MHD, Disruptions and Control, Naples, Italy, Oct. 2015 (included MST data by B. Chapman et al.)

261. Jay Anderson, *Dynamics of a Reconnection-Driven Runaway Ion Tail in a RFP Plasma*, 57th APS DPP Meeting, Savannah, GA, Nov. 2015

262. Eli Parke, *Characterization of beam-driven instabilities and current redistribution in MST plasmas*, 57th APS DPP Meeting, Savannah, GA, Nov. 2015

263. Stefano Munaretto, *Effect of Resonant Magnetic Perturbations on 3D equilibria in the MST RFP*, 57th APS DPP Meeting, Savannah, GA, Nov. 2015

264. Donald Spong, *Global gyrokinetic models for energetic particle driven Alfvèn instabilities in 3D equilibria*, 57th APS DPP Meeting, Savannah, GA, Nov. 2015

265. John Sarff, *The RFP Dynamo: MHD to Kinetic Regimes*, Workshop on The Dynamo Effect in Astrophysical and Laboratory Plasmas, Princeton Center for Theoretical Sciences, Princeton University, Dec. 2015

266. Lucas Morton, *Thermal transport in hot remnant magnetic islands*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
267. Ami DuBois, *Non-Classical Electron Energization Associated with Tearing Mode Reconnection in MST Plasmas*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
268. Craig Jacobson, *Validation and Verification of MHD Models for MST Reversed Field Pinch Plasmas*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
269. Stefano Munaretto, *Effect of magnetic perturbations on MST plasmas*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
270. Chris Hegna, *Shear Alfvèn continua and discrete modes in the presence of a magnetic island*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
271. Joseph Triana, *Measurement and Simulation of Two-Fluid Relaxation in Reversed-Field Pinch Plasmas*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
272. James Duff, *Evidence for density-gradient-driven trapped-electron modes in improved confinement RFP plasmas*, Exploratory Plasma and Fusion Research Workshop, Auburn, Feb. 2016
273. Karsten McCollam, *Comparing MHD simulations to RFP experiments*, Joint Meeting of the US-Japan MHD Workshop and ITPA MHD Disruption and Control Topical Group, National Institute for Fusion Science, Toki, Japan, Mar. 2016
274. Craig Jacobson, *Validation of MHD Models for MST Reversed Field Pinch Plasmas*, CPTC Plasma Theory Seminar, University of Wisconsin–Madison, Madison, Wisconsin, Mar. 2016
275. Karsten McCollam, *The MST experiment in the context of astrophysical and laboratory plasmas*, Kyoto Institute of Technology, Kyoto, Japan, Mar. 2016
276. Donald Spong, *Energetic particle physics issues in 3D systems*, JIFT collaboration visit, National Institute for Fusion Science, Toki, Japan, Mar. 2016
277. Stephanie Sears, *Plasma Science and Research Frontiers*, Undergraduate Seminar, Manchester University, North Manchester Indiana, Mar. 2016
278. Robert Granetz, *Report on closing joint experiment MDC-16 runaway electron generation, confinement, and loss*, 27th ITPA Topical Group Meeting on MHD, Disruptions and Control, Toki, Japan Mar. 2016 (included MST data by B. Chapman et al.)
279. Francesco Volpe, *Updates for WG?11 Control of Locked Modes, 27th ITPA Topical Group Meeting on MHD*, Disruptions and Control, Toki, Japan Mar. 2016 (included MST data by B. Chapman et al.)
280. Craig Jacobson, *Validation of MHD Models for MST Reversed Field Pinch Plasmas*, NIMROD Team Meeting, Madison, Wisconsin, Apr. 2016
281. James Duff, *Experimental Evidence for Density-Gradient-Driven Trapped-Electron Mode in Improved Confinement RFP Plasmas*, 2016 U.S. Transport Task Force Workshop, Denver, CO, Mar. 2016
282. Ami DuBois, *Particle Heating and Energization During Magnetic Reconnection Events in MST Plasmas*, 2016 US-Japan Workshop on Magnetic Reconnection, Napa, CA, Mar. 2016

283. Jay Anderson, *Generation of a Fast Electron Tail in the RFP via EBW Injection*, US-Japan Workshop on RF Heating Physics, Toyama, Japan, May 2016

284. Lisa Reusch, *Enhancement of fusion measurement capability using efficient multi-parameter and multi-diagnostic data analysis*, 18th International Congress on Plasma Physics, Kaohsiung, Taiwan, Jun. 2016

285. Takashi Nishizawa, *Basics of RFP and Drift Wave Measurements*, Kyoto Institute of Technology, Kyoto, Japan, Jun. 2016

286. John Sarff, *Opportunities and Context for Collaboration on Reversed Field Pinches*, 8th US-PRC Magnetic Fusion Collaboration Workshop, PPPL, Jun. 2016

287. Carl Sovinec, *Overview of Disruption-Related Research at UW-Madison*, Theory and Simulation of Disruptions Workshop, Princeton, Jul. 2016 (included MST data by B. Chapman et al.)

288. Donald Spong, *Gyrokinetic analysis of energetic particle instabilities 3D systems*, Gyrokinetics Symposium, Irvine, CA, Jul. 2016

289. Jay Anderson, *Preferential Confinement and Field-Aligned Acceleration of Energetic Ions in the RFP*, 11th International Conference on Open Magnetic Systems, Novosibirsk, Russia, Aug. 2016

290. Lisa Reusch, *A Tutorial on Bayesian Analysis for Science*, NSTX-U Monday Physics Meeting, PPPL, Aug. 2016

291. Karsten McCollam, *Simulations of MST and RELAX plasmas for validation studies*, NIMROD Team Meeting, Madison, Wisconsin, Aug. 2016.

292. Karsten McCollam, *Two-fluid magnetic relaxation in RFPs*, US-Japan CT Workshop, Irvine, California, Aug. 2016

293. Lisa Reusch, *An Introduction to Bayesian Analysis for Fusion Science*, UW-Madison Plasma Seminar, Sep. 2016

294. Daniel Den Hartog, *Measurement and modeling of transient phenomenon in the 3D edge of LHD*, UW-NIFS LHD Collaboration Workshop, Madison, Sep. 2016

295. Craig Jacobson, *Validation of Magnetically Confined Plasmas*, C. M. Jacobson, Scientific Computing Bootcamp (Teleconference), Woodruff Scientific, Seattle, Washington, Sep. 2016

296. B. Chapman, *Madison Symmetric Torus Tokamak Results*, 29th ITPA Topical Group Meeting on MHD, Disruptions and Control, Chengdu, China, Mar. 2017

297. J. Sarff, *Status and future of MST research*, 18th International RFP Workshop, Kyoto, Mar. 2017

298. M. Nornberg, *Electron turbulence and transport in large magnetic islands*, 18th International RFP Workshop, Kyoto, Mar. 2017

299. J. Boguski, *Experimental Studies of QSH dynamics*, 18th International RFP Workshop, Kyoto, Mar. 2017

300. J. Anderson, *Energetic ions in RFPs*, 18th International RFP Workshop, Kyoto, Mar. 2017

301. A. Almagri, *Particle energization processes in RFPs*, 18th International RFP Workshop, Kyoto, Mar. 2017

302. D. Spong, *Energetic particle-driven instabilities in reversed field pinches*, 18th International RFP Workshop, Kyoto, Mar. 2017
303. R. Fridström, *Estimation of anomalous viscosity in Madison Symmetric Torus*, 18th International RFP Workshop, Kyoto, Mar. 2017
304. J. Anderson, *Electron Bernstein Wave in RFPs*, 18th International RFP Workshop, Kyoto, Mar. 2017
305. T. Nishizawa, *Measurements of particle transport driven by micro-instabilities*, 18th International RFP Workshop, Kyoto, Mar. 2017
306. B. Chapman, *Measurements and modeling of MST RFP plasmas at low S and MST tokamak plasmas with an applied RMP*, 18th International RFP Workshop, Kyoto, Mar. 2017
307. K. McCollam, *Toward validation of extended MHD in RFPs*, 18th International RFP Workshop, Kyoto, Mar. 2017
308. J. Sarff, *Access to an ohmically heated fusion plasma based on the RFP*, 18th International RFP Workshop, Kyoto, Mar. 2017
309. A. DuBois, *Anisotropic Electron Tail Generation during Tearing Mode Magnetic Reconnection*, IPELS, Jun. 2017
310. K. McCollam, *RFP research toward ohmic ignition with high engineering beta*, U.S. Magnetic Fusion Research Strategic Directions Workshop, Madison, Wisconsin, Jul. 2017
311. J. Sarff, *The continuing need to pursue multiple confinement configuration research*, U.S. Magnetic Fusion Research Strategic Directions Workshop, Madison, Wisconsin, Jul. 2017
312. M. Pandya, *Suppression of High-Energy Electrons Generated in Both Steady and Disrupting MST Tokamak Plasmas*, Theory and Simulation of Disruptions Workshop, Princeton, Jul. 2017
313. A. Seltzman, *Observation of Electron Bernstein Wave Heating in the RFP*, The Exploratory Plasma and Fusion Research Workshop (EPR), Vancouver, British Columbia, Aug. 2017
314. Z. Xing, *Ion energy balance in enhanced-confinement reversed-field pinch plasmas*, The Exploratory Plasma and Fusion Research Workshop (EPR), Vancouver, British Columbia, Aug. 2017
315. M. Nornberg, *Using Integrated Data Analysis to optimize measurements critical to the validation of MHD simulations*, 1st Asia-Pacific Conference on Plasma Physics, Sep. 2017
316. K. McCollam, *Toward validation of extended MHD in RFPs*, NIFS, Toki, Japan, Sep. 2017
317. A. DuBois, *Anisotropic Electron Tail Generation during Tearing Mode Magnetic Reconnection*, 59th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Oct. 2017
318. D. Thuecks, *Drift waves in the turbulence of reversed field pinch plasmas*, 59th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Oct. 2017
319. R. Fridström, *Measurements and modeling of viscosity in a stochastic magnetic field*, 59th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Oct. 2017
320. B. Chapman, *Present pellet injection capabilities and potential plans for SPI on MST*, 30th ITPA Topical Group Meeting on MHD, Disruptions and Control, Barcelona, Spain, Oct. 2017

321. M. Nornberg, *Integrated Data Analysis techniques to create meta-diagnostics*, ITPA Diagnostics Topical Group, Oct. 2017

322. V. Mirnov, *Relativistic electron kinetic effects on laser diagnostics in burning plasmas*, 18th Symposium on Laser Aided Plasma Diagnostics, Prague, 2017

323. C. Jacobson, *Validation of MHD Models using MST RFP Plasmas*, 2nd IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Cambridge, 2017

324. L. Reusch, *Model Validation for Quantitative X-ray Measurements*, 2nd IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Cambridge, 2017

325. M. Nornberg, *Incorporating beam attenuation calculations into an integrated data analysis model for ion effective charge*, 2nd IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Cambridge, 2017

326. D. J. Den Hartog, *Developing Integrated Data Analysis techniques to optimize diagnostics for burning plasmas*, Community Input Meeting of the FESAC Transformative Enabling Capabilities (TEC) Subcommittee, Rockville, 2017

327. L. Reusch, *Using Integrated Data Analysis to Extend Measurement Capabilities*, High Temperature Plasma Diagnostic Conference (HTPD), San Diego, Apr. 2018

328. T. Nishizawa, *Impurity transport and zonal flows in improved-confinement reversed field pinch plasmas*, 60th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Nov. 2018

329. Z. Williams, *On Multi-Scale Interactions Among Microturbulence, Tearing Modes, and Zonal Flows*, 60th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Nov. 2018

330. P. Bonofiglo, *Fast Ion Transport in the Quasi-Single Helical Reversed-Field Pinch*, 60th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, Nov. 2018

331. J. Sarff, *Taming the energy of stars*, Chaos and Complex Systems Seminar, University of Wisconsin, Madison, Mar. 2019

332. A. Almagri, *Transport and fluctuations in Reversed Field Pinch*, Symposium in honor of Stewart Prager, PPPL, Apr. 2019

333. B. Chapman, *MHD self-organization in tokamak plasmas*, Symposium in honor of Stewart Prager, PPPL, Apr. 2019

334. W. Ding, *Current relaxation and dynamo in a RFP and a tokamak*, Symposium in honor of Stewart Prager, PPPL, Apr. 2019

335. K. McCollam, *The Wisconsin Plasma Physics Laboratory: Reconnecting to CMSO*, Symposium in honor of Stewart Prager, PPPL, Apr. 2019

336. J. Sarff, *Making Self-organized Tori (MST)*, Symposium in honor of Stewart Prager, PPPL, Apr. 2019

337. J. Sarff, *The opportunity for an ohmically heated and inductively sustained steady-state fusion power core*, 1st International Conference on Innovative Fusion Approaches, Xi'an, China, May 2019

338. K.J. McCollam, *Reversed-field pinch research toward ohmic ignition at high engineering beta, Joint Community Planning Workshop for Magnetic Fusion Energy and Fusion Materials and Technology*, Madison, Wisconsin, Jul. 2019

339. D. Den Hartog, *X-ray microcalorimeter spectroscopy and other research on MST*, seminar, Kyoto Institute of Technology, Japan, Aug. 2019
340. D. Den Hartog, *Plasma Diagnostic Technique for Fusion Research*, JSPS PLADyS Summer School, Hikone, Japan, Aug. 2019
341. J. Anderson, *Fast ion confinement in the 3D helical reversed field pinch*, 2nd International Stellarator and Heliotron Workshop, Madison, Wisconsin, Aug. 2019
342. J. Boguski, *Direct measurements of the 3D plasma flow velocity in single-helical-axis RFP plasmas*, 61st Annual Meeting of the APS Division of Plasma Physics, Ft. Lauderdale, Oct. 2019
343. J. Sarff, *Taming the energy of stars*, UW Space Place and Wisconsin Public Television, Madison, WI, Oct. 2019 https://pbswisconsin.org/watch/university-place/taming-the-energy-of-stars-re9iha/