Final Report

1. **Project Title: New Mexico Solar and Stellar Seismology**
2. **Grant Number: NNX09AP76A**
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5. **Grant Institution: New Mexico State University**
6. **Grant start date: August 1, 2009**
7. **Date of Report: 06/13/2014, Year 5, Final Report**

8. **Research Accomplishments measured against proposed goals and objectives**

The objective of this program was to build the infrastructure needed for New Mexico to become nationally competitive for grants in the fields of solar and stellar seismology. Our goals are closely connected to NASA Strategic Goal 3B "Understand the Sun and its effect on Earth and the solar system" and the NASA program "Living With a Star". Below is a discussion of completed work and student achievements in each of the project's three targeted areas.

a. *Developing theory and software needed to explore the interior structure of the Sun***.**

- Software has been written to analyze Kepler measurements of the brightness changes of stars. Specifically, programs have been written to produce a power spectrum, and a table of the star's frequencies, amplitudes, and phases and to analyze the nature of these frequencies.

- Astronomy Department students: Project student Gordon MacDonald was awarded a NASA Graduate Fellowship to study space weather in 2014. Sam Schonfeld and Gordon MacDonald was awarded 2013 and 2014 AFRL summer fellowships to work with staff of the AF Center for Excellence in Space Weather. Gordon MacDonald was awarded a NASA Graduate Student Fellowship in 2014. Post docs Andic and Gangadharan worked with faculty member McAteer on the submission of proposals for over $500,000 for continued work on this topic.

- Electrical and Computer Science students: Project student Amani Al-Ghraibah continues

to work with Dr. Boucheron (NMSU Electrical and Computer Engineering) on codes that identify transient features in digital images of the Sun. She defended her Master's thesis in December 2012 and is now working on her Ph.D. A second student Maghala Valluri completed her Master's thesis in Summer 2013.

- A new inversion code has been developed to handle computations of several years of solar seismic data. An optimization scheme is utilized that allows the program to run on parallel processors. Project graduate student Kyle DeGrave is competing his Ph.D. on this topic.

- Significant work has been completed on the construction of an automated software package for the prediction of coronal mass ejections from the Sun. This work served as the basis of a Ph.D. dissertation for project graduate student Michael Kirk who graduated in May 2013. He is now at NASA's Goddard Space Flight Center.

- Greg Taylor worked with T. Rimmile (the National Solar Observatory) on a third-generation adaptive optics system that can be used to view activity on the solar limb. This project served as the basis of his Ph.D. which was completed in spring 2014.

b. Broadening the use of solar models to other stars.

Our group continues to make progress in this area. To date we have been competitively awarded guest observer status on 11 Kepler proposals and major papers have been published on B-stars and Red Giant stars using Kepler data. Other members of the astronomy department have also published papers on spotted late-type stars using Kepler data.

- Project student Jean McKeever has begun her Ph.D. dissertation work by utilizing much of this software to study giant stars in the Kepler database. Kyle DeGrave is within one year of completing his Ph.D. dissertation. Laura Mayorga was awarded a NSF Graduate Fellowship to study extra-solar planets. Nicolas Ule is completing his dissertation of spotted late-type stars. Meredith Rawls is completing her Ph.D. of binary star systems.

- Post doc support has been received from LANL to support studied of red giant stars, and two international visitors have come to NMSU to collaborate on studies using Kepler data.

c. Characterizing stars that have been discovered to possess planetary systems. None of the Kepler stars studied so far show evidence of planetary systems. Our current work has been confined to upper main sequence stars and red giant stars where planetary systems are not likely to be found.

9. Systemic changes related to NASA EPSCoR funding

Improvements in the jurisdiction's research and development infrastructure: A major goal of our proposal was: "To develop research infrastructure in solar and stellar seismology among New Mexico's universities (NMSU, UNM), national laboratories (LANL, NSO, AFRL) and

the New Mexico Space Grant Program." To meet this objective NMSU pledged to hire two faculty in project related areas. In this regard NMSU has exceeded its commitment since it has hired three new faculty members.

1. Dr. James McAteer was selected to join the NMSU Astronomy Department in Fall 2010. He has expertise in heliophysics and space weather and works with researchers at NMSU, UNM, NSO, LANL, and the AFRL.

2. Dr. Laura Boucheron joined the NMSU Department of Electrical and Computer Engineering in Fall 2011. Her research field is the automated recognition of features in digital images. She will strengthen collaborative ties between NMSU and the AFRL.

3. Dr. Huiping Cao joined the NMSU Computer Science Department in Fall 2011. Her hire did not involve EpsCor funds, but her research field is closely tied to project activities. Her expertise is in the area of large data-base management. This area is of interest to our EpsCor partners NSO, LANL, and AFRL as well as Sandia National Laboratory.

Three post-docs have also worked in our group. Dr. Aleksandra Andic who conducted observational studies of the Sun's chromosphere and the interaction of solar magnetic activity with solar oscillations. Dr. Vigeesh Gangasharan who computed MHD simulations of the solar atmosphere, and Dr. Patrict Gaulme who worked in the field of asteroseismolgy using Kepler data. We anticipate hiring a new post-doc during fall 2014.

Increased financial commitment from the jurisdiction, industry, and participating institutions. Much progress has taken place in this area. Two NMSU graduate students have been named as Space Scholars by AFRL for multiple years, Sam Schonfeld and Gordon MacDonald. Their off-campus work is being done under the guidance of mentors at the AFRL Center for Excellence in Space Weather in Albuquerque. Other notable commitments include the following:

- NMSU graduate student Laura Mayorga was awarded a $120,000 NSF Graduate Fellowship. Gordon MacDonald received a NASA Graduate Student Fellowship.

- LANL support for two NMSU computer science faculty members to work on software development related to solar activity.

- AFRL support for one graduate student at UNM to work on problems associated with heliophysics. Two NMSU graduate students received AFRL Summer Fellowships for 2013 and 2014.

- LANL support for an NMSU a three-year post-doc position in asteroseimology.

- An internally competed multi-year graduate student fellowship has been awarded to project graduate student Greg Taylor by NMSU to work with Dr. Rimmile (NSO).

- An internally competed research award was given to Drs. McAteer and Boucheron by NMSU to work on a solar limb adaptive optics project (with Rimmele NSO).

- An internally competed a research award has been given to Drs. Jackiewicz and Cao by NMSU to work on large base management solar physics problems.

- An Educational Partnership agreement was signed in Fall 2011 between NMSU and the AFRL to conduct joint research projects in heliophysics and space weather. To date two research awards have been made to NMSU faculty on the basis of that agreement.

a. *Response of activities to NASA jurisdiction priorities*

1) Dr. McNamara has recently completed his service as a member of the Kepler Users Panel. This groups met once/twice per year at NASA Ames to review the Kepler team's plans and to make recommendations for improvements.

2) Dr. McNamara served as a 2013 panel chair for the NASA Kepler guest observer program. Drs. Gangadaran (NMSU) and Lovekin (LANL) also served on this review. The Kepler panels met for 5 days in Washington D.C. and reviewed guest observer proposals.

3) Dr. McNamara served as a member of the 2013 NASA APD review panel.

4) We have been working with Dr. Dean Pesnell of Goddard Space Flight Center. Dr. Pesnell is the PI of NASA's newly launched Solar Dynamics Observatory (SDO). Dr. Jackiewicz (NMSU EPSCoR co P.I.) is a member of the SDO Analysis Team.

5) Jackiewicz has been working on a major new variable star initiative called SONG (Stellar Observations Network Group). This international project involves collaborators with European and Chinese institutes. SONG will be able to detect extra-solar planets using precise radial velocity measurements, a technique that is complementary to the light curve approach being used by the NASA Kepler satellite.

6) We have developed a strong relation with AFRL Center for Excellence in Space Weather which has resulted in support for three graduate students and one post doc.

7) We have developed a close relation with the National Solar Observatory. Two of our project students completed portions of their Ph.D. at their facilities. Greg Taylor developed a new third generation adaptive optics systems using the NSO Dunn Solar Telescope.

8) Research ties between NMSU and LANL continue to be strengthened through the submission of joint NASA Kepler proposals. Dr. Gaulme was supported by LANL.

a. *Re-ordered jurisdiction and/or institutional priorities*

The AFRL Center for Excellence in Space Weather now recognizes NMSU, the New Mexico Institute of Technology, and the University of New Mexico (UNM) as important sites to meet their future workforce needs. It has signed a memorandum of understanding for joint educational and research efforts with each of these universities. The University of New Mexico is our EpsCor partner. AFRL has already sent staff members to participate in their teaching programs. At the request of the New Mexico Space Grant Consortium our group sent representatives to the dedication ceremony of Spaceport America in Upham, NM. Dr. McNamara has completed an on-line text on human spaceflight that includes a new section on NASA's efforts to stimulate the development of a U.S. commercial space flight industry.

The National Solar Observatory (NSO) staff will shortly leave the state for Colorado. NMSU is undertaking discussions with the NSO, NSF, and other universities about assuming a leadership role in the future use of their Sunspot, NM facilities.

10. Examples of successful technology transfer to the private sector

None

11. Extent to which collaborations with jurisdiction agencies, industry, research and academic institutions, and NASA have evolved.

Collaborations based on this project have continued to evolve

a. AFRL is supporting NMSU graduate students Gordon MacDonald and Sam Schonfeld to work with AFRL Center for Excellence in Space Weather mentors during summer 2013. They worked with Sam on his successful NASA Graduate Student Fellowship proposal. They are also funding a post-doc position at NMSU.
b. A more extensive collaboration with LANL has developed around the Kepler program. NMSU and LANL scientific staff are co-Is on several jointly submitted proposals to this program and LANL supports a Post-doc at NMSU in asteroseismology.
c. Two NMSU faculty served on the 2013 NASA Kepler guest observer proposal review panels.
d. NMSU graduate student Greg Taylor completed his Ph.D. dissertation working with Dr. Rimmile of the NSO on a third generation adaptive optics system in May 2014.
e. This past summer NMSU had one undergraduate student working at the AFRL as part of its summer outreach program (Delgado, F). He has now graduated from NMSU and is pursuing an advanced degree in solar physics at Montana State University.
f. NMSU serves as the host institute for students requesting travel support to all national solar meetings. This resulted from the submission of successful joint NMSU/NSO

12. Discussion of interaction between and cooperation with the jurisdiction's Space Grant Consortium.

The NM Space Grant Consortium helps identify colleagues at institutions within the district that have similar research goals to those of the project. It holds a yearly meeting at which EpsCor groups report project results and seek additional contacts. They also provide technical support on the expenditure of project funds, administrative support, and assist on the submission of project reports.

13. Research success of individual investigators as measured by:

a. Articles submitted to or published in refereed journals

1. Ahluwaluia, H., Ygbuhay, R., *Preliminary forecast for the peak of solar activity cycle 24*, 2009, Advances in Solar Research, 44, 611.

2. Grigahcene, A. et al. (co-authors Jackiewicz, Guzik). *Hybrid gamma Doradus-delta Scuti pulsators: New insights into the physics of the oscillations from Kepler.* 2010, Astrophysical Journal Letters, 713, L192

3. Moradi, Baldner, Birch, Braun, Cameron, Duvall Jr, Gizon, Haber, Hanasoge, Hindman, Jackiewicz, et al., *Modeling the subsurface structure of sunspots*, 2010, Solar Physics, 267,1

4. Byrne, J. P., Maloney, S.A., McAteer, R.T.J., Refojo, J.M., Gallagher, P.T. *Propagation of an Earth-directed coronal mass ejection in three dimensions*, 2010, Nature Communications, Volume 1, Issue 6, 74.

5. Conlon, P.A., McAteer, R.T.J., Gallagher, P.T., Fennell, L. *Quantifying the Evolving Magnetic Structure of Active Regions*, 2010, Astrophysical Journal, 722, 577.

6. Milligan, R.O., McAteer, R.T.J., Dennis, B.R., Young, C.A., *Evidence of a Plasmoid-Looptop Interaction and Magnetic Inflows During a Solar Flare/Coronal Mass Ejection Eruptive Event*, 2010, Astrophysical Journal, 713, 1292

7. McNamara, J., *The Dynamical Distance, RR Lyrae Absolute Magnitude, and Age of the Globular Cluster NGC 6266*, 2011, Astronomical Journal, 142, 163.

8. Long, D., McAteer, R.T.J., Bloomfield, D.S., Gallagher, P.T., *Deceleration and dispersion of large-scale bright fronts*, 2011, Astronomy & Astrphysics, 531, 42.

9. Uytterhoeven, K.; Jackiewicz, J. et al. *The Kepler characterization of the variability among A- and F-type stars. I. General overview*, 2011, Astronomy & Astrophysics, 534, 125.

10. Gallagher, P, McAteer, J. et al., *Coronal mass ejection detection using wavelets, curvelets, and ridgelets, Applications for space weather monitoring*, 2011, AdSpR 47, 2118.

11. Harrison, T, McNamara, B., et al. *Spitzer Observations of GX17+2: Confirmation of a Periodic Synchrotron Source*, 2011, Astrophysical Journal, 736, 54.

12. Higgins, P., McAteer, J. et al. *Solar magnetic feature detection and tracking for space weather monitoring*, 2011, AdSpR 47, 2105.

13. Long, D., McAteer, J. *Deceleration and dispersion of large-scale coronal bright front*, 2011, Astronomy & Astrophysics, 531, 42.

14. McNamara, B., et al, *The Internal Proper Motions of Stars in the Open Cluster M35*, 2011, Astronomical Journal, 142, 53.

15. Jackiewicz, J., et al. *Multichannel Three-Dimensional SOLA Inversion for Local Helioseismology*, 2012, SoPh, 276, 19.

16. Martens, P., McAteer, J., *Computer Vision for the Solar Dynamics Observatory (SDO*), 2012, Solar Physics, 275, 79.

17. McNamara, B., *Erratum: The Dynamical Distance, RR Lyrae Absolute Magnitude, and Age of the Globular Cluster NGC 6266*. 2012 Astronomical Journal, 143, 53.

18. McNamara, B., et al, *A Search for an Intermediate Mass Black Hole in the Core of the Globular Cluster NGC 6266*. 2012, Astrophysical Journal, 745, 175.

19. McNamara, B., et al, *The Classification of Kepler B-Star Variables*, 2012, Astronomical Journal, 143, 101.

20. Kirk, Michael S.; Balasubramaniam, K. S.; Jackiewicz, Jason; McAteer, R. T. James; Milligan, Ryan O., *Properties of Sequential Chromospheric Brightenings and Associated Flare Ribbons*, 2012, Astrophysical Journal, 750, 145.

21. Taylor, Rimmele, Marino, Tritschler, McAteer, *Solar Limb Adaptive Optics,* 2012, ASPC,463, 321

22. Ahluwalia, H. S., Jackiewicz, J. *Sunspot cycle 23 descent to an unusual minimum and forecasts for cycle 24 activity,* 2012, Advances in Space Research, 50, 662

23. Carley, Eoin P.; McAteer, R. T. James; Gallagher, Peter T., *Coronal Mass Ejection Mass, Energy, and Force Estimates Using STEREO*, 2012, Astrophysical Journal, 752, 36.

24. Carley, E. P.; McCauley, J.; Gallagher, P. T.; Monstein, C.; McAteer, R. T. J., *Observations of Low Frequency Solar Radio Bursts from the Rosse Solar-Terrestrial Observatory,* 2012, Solar Physics, 280, 591

25. Vigeesh, G.; Fedun, V.; Hasan, S. S.; Erdélyi, R., *Three-dimensional Simulations of Magnetohydrodynamic Waves in Magnetized Solar Atmosphere*, 2012, Astrophysical Journal, 755, 18.

26. Huiping Cao, Shawn Bowers, Mark P. Schildhauer, *Database Support for Enabling Data-Discovery Queries over Semantically-Annotated Observational Data, 2012*, Transactions of Large Data and Knowledge Systems 6: 198-228.

27. Jackiewicz, J, Nettelmann, N, Marley, M. Fortney, J., *Forward and inverse modeling for jovian seismology*. 2012, Icarus 220, 844.

28. DeGrave, K. Jackiewicz, J., *Example inversion for a new generalized time-distance helioseismology pipeline.*. 2012, Astronomische Nachrichten, 333, 998

29. Bloomfield, D., McAteer, J, et al., *Toward Reliable Benchmarking of Solar Flare Forecasting Methods*, 2012, Astrophysical Journal, 747, 41.

30. Kirk, M. S.; Balasubramaniam, K. S.; Jackiewicz, J.; McNamara, B. J.; McAteer, R. T. J., *An Automated Algorithm to Distinguish and Characterize Solar Flares and Associated Sequential Chromospheric Brightenings,* 2013, Solar Physics, 283, 97

31. Guzik, J., Jackiewicz, J., Bradley, P., Uytterhoeven, K., Kinemuchi, K. *The occurence of non-pulsating stars in the gamma Doradus/delta Scuti pulsation instability region*. 2013, Astronomical Review, Vol 8.4, p 4-30.

32. Jackiewicz, J. & Balasubramaniam, K.S., *.Solar H-alpha Oscillations from Intensity and Doppler Observations*. 2013, Astrophysical Journal, 765, 15

33. Gaulme, McKeever, Rawls, Jackiewicz, Mosser, Guzik, *Red Giants in Eclipsing Binary and Multiple-Star Systems: Modeling and Asteroseismic Analysis of 70 Candidates from Kepler Data,* 2013, Astrophysical Journal, 767, 82

34. Pápics, P. I.; Tkachenko, A.; Aerts, C.; Briquet, M.; Marcos-Arenal, P.; Beck, P. G.; Uytterhoeven, K.; Triviño Hage, A.; Southworth, J.; Clubb, K. I.; Bloemen, S.; Degroote, P.; Jackiewicz, J.; McKeever, J.; Van Winckel, H.; Niemczura, E.; Gameiro, J.. *Two new SB2 binaries with main sequence B-type pulsators in the Kepler field.* 2013, Astronomy & Astrophysics 553, 127.

35. Calabro, B., McAteer,R., Bloomfield, D., *Oscillatory Behavior in the Corona*, 2013, Astrophysical Journal, 7876, 66.

36. Andic, A. *A Small Pore Observed with a 1.6m Telescope*, 2013, Solar Physics, 282, 443

37. Andic, A. et al. *Connection Between Chromospheric Events and Photospheric Dynamics*, 2013, Solar Physics, 288, 55.

38. Jackiewicz, J, Balasubramaniam, B., *Solar H-alpha Oscillations from Intensity and Doppler Observations*, 2013, Astrophysical Journal, 765, 15

39. Bryne, J., Long, D., Gallagher, P., Bloomfield, S., Maloney, S., McAteer, R. T. J., Morgan, H., Habbal, Improved methods for determining the kinematics of coronal mass ejections and coronal waves, 2013, Astronomy & Astrophysics, 557, A96.

40. Andic, A., McAteer, R. T. J., Remote Oscillatory responses to a solar flare, 2013, Astrophysical Journal, 772, 54

41. McAteer, R.T.J., Bloomfield, D.S., The Bursty Nature of Solar Flare X-Ray Emission. II. The Neupert Effect, 2013, Astrophysical Journal, 776, 66

42. Reef, J., Steven, B., McAteer, R. T. J., *On the sensitivity of the GOES flare classification to properties of the electron beam in the thick target model*, 2014, Astrophysical Journal, 778, 76

43. Kholikov, S., Serebryanskiy, A., Jackiewicz, J, *Gravity waves in magnetized solar atmospheres from MHD simulations*, 2014, Astrophysical Journal, 784, 145.

44. Al-Ghraibah, A., Boucheron, L. E., McAteer, R. T. J., *An Automated Approach to Ranking Photospheric Proxies of Magnetic Energy Buildup*, 2014, Astrophysical Journal, submitted

45. Taylor, G., Rimmele, T., Marino, J., McAteer, R. T. J. *An Off-Limb Solar Adaptive Optics System*., 2014, Solar physics, submitted

46. Kirk, M. et al. Qualities of Sequential Chromospheric Brightenings Observed in Optical and UV Wavelengths, 2014, Astrophysical Journal, submitted.

47. Valluri, M, Bourcheron, L, *Segmentation of Coronal Holes with Active Contours and Detection of Boundary Flashes,* 2014, Solar Physics, expected submission in summer 2014

48. Al-Ghraibah, *Solar Flare Size and Time-of-Flare Prediction Using Support Vector Machine (SVM) Regression*," 2014, Astrophysical Journal, expected submission in summer 2014

49. Chuan Hu, Huiping Cao, Yifan Hao, Kabi Bhattarai, Satyajayant Misra: K-anonymity for Social Networks Containing Rich Structural and Textual Information, 2014, Springer Social Network Analysis and Mining (submitted), 2014

50. Yifan Hao, Huiping Cao, Yan Qi: Efficient Keyword Search on Graphs using MapReduce, 2014 , Springer Knowledge and Information Systems, (submitted), 2014

b. Talks, presentations, or abstracts at professional meetings since our last report

1. Kirk, M, & Pesnell, D., "Automated Detection of Polar Coronal Holes in the EUV" (Honorable Mention, Student Poster Competition), AAS Solar Physics Division meeting, June 2009.

2. Kirk, M & Balasubramaniam, K.S., "Automated Characterization of Sequential Chromospheric Brightenings", American Geophysical Union meeting, Dec 2009.

3. Kirk, K. S. Balasubramaniam , J. Jackiewicz , B. J. McNamara, "Understanding the Physics of Sequential Chromospheric Brightenings of the Sun Through Automated Recognition", American Astronomical Society meeting, Jan 2010

4. Jackiewicz, J., "The U.S. Contribution to SONG", The Third SONG Workshop, Beijing, China, Mar 2010

5. Michael Kirk, "Models of Solar Activity", NSO, Sunspot, NM, Apr 2010.

6. Rose Perea, "Asteroseismology using Kepler Data", NSO Sunspot, Apr 2010.

7. Son To, "A Solar and Stellar Data Management System", NSO , Sunspot, Apr 2010.

8. Kirk, M, "Magnetic Fields in the Solar Atmosphere", NMSU Pizza-Lunch Seminar, Las Cruces, NM, Apr 2010.

9. Kirk, M., "Seeing the Solar Surface: The Physics of Sequential Chromospheric Brightenings and their Automated Recognition", NSO Summer Colloquium, Sunspot, NM, Aug 2009.

10. McNamara, B., "Stellar and Solar Seismology", NMSU Astronomy, Sept 2009.

11. McNamaram B., Jackiwiez, J., "Stellar and Solar Seismology", NSO, Tucson, Arizona, Oct 2009.

12. Jackiewicz, J., "Seismology of the Sun", Embry-Riddle Aeronautical University, Prescott, AZ, Oct 2009.

13. Jackkiewicz, J., "Solar Interior Seismology", Department of Physics, NMSU, invited colloquium, Nov 5, 2009,

14. Jackiewicz, J., "Space Weather Related Research at New Mexico State University". AFRL, Albuquerque, NM, Mar 2010.

15. Calabro, B., "Automated Detection of Oscillatory Behavior in the Corona", Solar Physics Division Meeting of American Astronomical Society Meeting, May 2010

16. DeGrave, K., “F-mode seismology of solar simulations”, Solar Physics Division Meeting of of American Astronomical Society Meeting, May 2010

17. Jackiewicz, J., “Solar Oscillations and acoustic power measured in H-alpha”, Solar Physics Division Meeting of the American Astronomical Society Meeting, May 2010.

18. Kirk, M., “Characterizing Chromospheric Flares and Sequential Brightenings”, Solar Physics Division Meeting of of American Astronomical Society Meeting, May 2010.

19. Kirk, M., “Connecting Ephermeral Chromospheric Brightenings to Coronal Loops”, Solar Physics Division Meeting of of American Astronomical Society Meeting, May 2010.

20. Ghraibah, A., “Fields, Flares, and Forecasts”, Solar Physics Division Meeting of American Astronomical Society Meeting, May 2010

21. Guzik, J., **“**Observations of 14 Delta Scuti and Gamma Doradus Star Candidates for the Kepler Guest Observer Program Cycle 1”. Third Kepler Asteroseismology Workshop: Kepler Asteroseismology in Action.” Aarhus, Denmark, June 2010.

22. Guzik, J., “Helioseismology of Sunspots: An Extended Analysis of AR9787.” Conference: “A New Era of Seismology of the Sun and Solar-like Stars.” Aix-en-Provence, France, June/July 2010.

23. Jackiewicz, J., “Time-distance helioseismology inversions around sunspots – no consensus”, NSO, Tucson, Arizona, Aug 2010.

24. Jackiewicz, J., “Imaging the depths of the Sun with helioseismology”, Boston College, Sept 2010.

25. Kirk, M., “Automated Characterization of Large Flares and Associated Sequential Chromospheric Brightenings,” Solar Image Processing Workshop V, Sept 2010.

26. McAteer, J., “The 3D CME: Lessons learned, confirmed, and unearned from STEREO”, invited colloquium at National Solar Observatory, University of Arizona, Tucson, Arizona, Oct 2010.

27. McAteer, J., “The 3D CME: Lessons learned, confirmed, and unearned from STEREO”, invited colloquium at National Solar Observatory, Sunspot, Tucson, New Mexico, Nov 2010.

28. Kirk, M., “Properties of Solar Flares and Associated Sequential Chromospheric Brightenings,” AGU Fall Meeting, Dec 2010.

29. McNamara, B., “The influence of Rotation on the Pulsation Spectra of B stars”, Solar Physics Division Meeting of the American Astronomical Society Meeting, May 2011.

30. McNamara, B., ”The Pulsation Spectra of Kepler B-stars”, American Astronomical Society, Boston, MA, May 2011.

31. Pevtsov, A., “Coronal Loop detection and seismology”, Solar Physics Division Meeting of of American Astronomical Society Meeting, May 2011.

33. Calabro, B., McAteer, J., Pevtsov, A., “Why is the Sun hot?”, Undergraduate Research Conference Poster Session, Sept 2011.

34. Calabro, B., “3- and 5- Minute Oscillatory Behavior in the Solar Corona”, American Physical Society 4 Corners Section Meeting, Oct 2011.

35. Hao, Y., “Intelligent Search of Solar Data”, American Astronomical Society Conference, Jan 2012.

36. Al-Ghraibah, A., “Automated Classification of Flaring Behavior in Solar Active Regions: Preliminary Results”, American Astronomical Society Conference, Jan 2012.

37. Calabro, B., “Detecting Flows, Waves and Nanoflares in the Solar Corona”, American Astronomical Society Conference, Jan 2012.

38. Calabro, B., “Oscillations”, NMSU Society of Physics Students (SPS) Undergraduate Lecture Series, Las Cruces, New Mexico, Feb 2012.

39. Jackiewicz, J., Gangadharan, V., “LWS Workshop 2012: Local Helioseismology-Data Analysis, Modeling and Comparison”, Invited Colloquium, Tucson, Arizona, Mar 2012.

40. Jackiewicz, J. & Gangadharan, V., “Seismology of small-scale magnetic features from simulations’, LWS Workshop 2012, Tucson, AZ, Mar 2012.

41. Andic, A., “Speckle Reconstruction Technique”, NMSU Solar & Stellar Physics Group Meeting, Las Cruces, New Mexico, Mar 2012.

42. Jackiewicz, J., “"Oscillatory power observed in flares and filaments." 26th NSO Workshop, Sac. Peak, NM, May 2012.

43. Jackiewicz, J., “Oscillatory power observed in flares and filaments." 26th NSO Workshop, Sac. Peak, NM, May 2012.

44. Gangadharan, V., “Acoustic emission from flux tubes in the solar network”, 26th NSO Workshop, May 2012.

45. Andic, A., “Waves and Flares”, American Astronomical Society Conference, June 2012.

47. Kirk, M., “Automated recognition of Solar features for developing data driven prediction models of coronal mass ejections and space weather”, AFOSR Space Science Program

review, June 2011.

48. McKeever, J., “The Pulsation of Red Giant Branch Stars ”, Fourth SONG Workshop, Sept 2011.

49. Jackiewicz, J., “Suitability of the Apache Point Observatory 1m telescope for the Song Spectrograph”, Fourth SONG Workshop, Sept 2011.

50. Kirk, M., “Connecting Ephermal Chromospheric Brightenings to Coronal Loops”, 27th Annual New Mexico Symposium, Oct 2011.

51. Kirk, M., “Physics of Ephemeral Chromospheric Brightenings”, Invited Colloquium at Air Force Research Laboratory, Albuquerque, New Mexico, Oct 2011.

52. Pevtsov, A., “Coronal Loop and Seismology”, American Physical Society Four Corners Section Meeting, Oct 2011.

53. Kirk, M., “Extracting Physics of Flares Through Sequential Chromospheric Brightenings”, New Mexico Symposium, Oct 2011,

54. Kirk, M., “Sequential Chromopheric Brightening: An automated approach to extracting physics from ephemeral brightening”, ATST EAST Meeting, Washington, DC, Nov 2011.

55. Taylor, G., “Solar Limb AO: A Test of a Phase-Diversity Sensor and Algorithms”, ATST/EAST Conference, Nov 2011.

56. Kirk, M., “Mapping the dynamics of chromospherioc flares”, AGU Fall meeting Dec 2011.

57. Kirk, M., “Chromospheric Explosions: Linking Observations Toward a Physical Model”, American Astronomical Society Conference, Jan 2012.

58. McKeever, J. “Unusual Pulsation Properties of Red Giant Branch Stars in Kepler”, American Astronomical Society Conference, Jan 2012.

59. McNamara, B., “Pulsating B Stars observed by Kepler”, American Astronomical Society Conference, Jan 2012.

60. Pevtsov, A., “Coronal Loop Detection and Seismology”, American Astronomical Society Conference, Jan 2012.

61. Taylor, G., “Nick Arge (AFRL): Solar Wind”, Invited Colloquium at New Mexico State University, Las Cruces, New Mexico, Mar 2012.

62. Bourcheron, L. “Image Processing and Pattern Recognition: General Approaches and Application to Solar Data”, Solar Information Processing Workshop, Aug 2012.

63. Valluri, M., Bourcheron, L, McAteerm J., “Segmentation of Coronal Holes Using Active Contours and Detection of Small Boundary Flashes”. Solar Information Processing Workshop, Aug 2012.

64. Gaulme, P., “Towards a breakthrough in the knowledge of internal structure of giant planets”, European Planetary Science Congress, invited talk, 2012.

65. Gaulme, McKeever, Rawls, Jackiewicz, Mosser, “Red Giants in Eclipsing Binary Systems: Analysis of 53 Lightcurves from Kepler Data”, Progress in physics of the sun and stars: a new era in helio- and asteroseismology, 2012.

66. MacDonald, G., “Enhanced Up-Flows Observed on the Solar Granules, Solar in Sonoma”, Tracing the Connections in Solar Eruptive Events, 2012.

67. Schonfeld, S., Chamberlin, P., “Observations of the Neupert Effect with SDO and RHESSI”, Solar in Sonoma: Tracing the Connections in Solar Eruptive Events, 2012.

68. Calabro, B., McAteer, R.T.J., Bloomfield, S.. “Observations of Oscillatory Behavior in the Corona”, American Physical Society, 2012.

69. Jackiewicz, J., “Precision Astrophysics Experiments with the Kepler Satellite”, APS 4-Corners Meeting, invited talk, 2012.

70. Ramesh, E., “Small-scale magnetic features in a simulated Sun”, APS 4-Corners Meeting, 2012.

71. Calabro, B., McAteer, R.T.J., Pevtsov. A., “Detecting Flows, Waves and Nanoflares in the Solar Corona”, American Astronomical Society, 2012.

72. McAteer, J., “Automated coronal seismology”, BUKS conference, Crete, invited talk, 2012.

73. DeGrave, K., Jackiewicz, Braun, “Probing the Three-Dimensional Structure of Solar Supergranulation Using Local Helioseismology”, The Modern Era of Helio- and Asteroseismology, 2012.

74. Jackiewicz, J., “How Best to Utilize Time-Distance Inversions”, Contributed talk, LWS Workshop. Feb 2013.

75. DeGrave, K., “Time-Distance Helioseismology of Realistic Solar Simulations”, LWS Workshop, Feb 2013.

76. Schonfeld, S., “Using ADAPT and EUV to better understand F10.7 physics”, AFRL ADAPT group meeting, invited talk, Mar 2013.

77. MacDonald, G., McAteer, R. T. J., AFRL ADAPT workshop, "Solar far side imaging", Mar 2013.

78. Andic, A., McAteer, J., “The oscillatory response to solar flares”, SDO meeting, Mar 2013.

79. MacDonlad, G., “Comparing an Active Regions Structure Derived From Near-Side and ADAPT”, ADAPT Working Meeting, invited talk, Mar 2013.

80. Schonfeld, S., White, McAteer, “The solar 10.7 radio emission”, ADAPT workshop, Apr 2013.

81. McAteer, R. T. J., "Space Weather from ADAPT maps", AFRL ADAPT workshop, AFRL, Albuquerque, Apr 2013.

82. McDonald, G., Arge, McAteer, “Calibrating ADAPT maps”, ADAPT workshop, Apr 2013.

83. Schonfeld, S., McAteer, R. T. J., "Solar radio emission", AFRL ADAPT workshop, Apr 2013.

84. McAteer, R. T. J., "Flare prediction results from All-Clear worhsop", Space Weather Week, Boulder, Scope: International. Apr 2013.

85. McAteer, R. T. J., "Multifractals and Turbulence", Flare Prediction Workshop, NWRA-NASA, Boulder, Apr 2013.

86. McAteer, J., “Flare prediction”, ADAPT workshop Apr 2013.

87. Degrave, K & J. Jackiewicz, J “Validating Time-Distance Helioseismology with Quiet Sun and Sunspot Simulations”, Fifty Years of Seismology of the Sun and Stars, May 2013.

88. Jackiewicz, J., “Recent results from the time-distance technique”, Fifty Years of Seismology of the Sun and Stars, NSO Tucson, invited talk, May 2013.

89. Vigeesh, V & Jackiewicz, J., “Seismology of Small-Scale Magnetic Features using Numerical Simulations”, Fifty Years of Seismology of the Sun and Stars, May 2013.

90. Hao, Y & Cao, H., “STK-Anonymity, “K-Anonymity of Social Networks Containing both Structural and Textural information”, DBSocial, June 2013.

91. Hao, Y & Cao, H., “Efficient Keyword Search on Graphs using MapReduce”, Intl. Conf. on Information and Knowledge Management., June 2013

92. Andic, A. & McAteer, J.,”Flares, Waves , and Energy”, SPD, June 2013.

93. Reep, J., Bradshaw, S., McAteer, R. T. J., AAS SPD 2013, "On the sensitivity of GOES flare classification to the collisional thick-target model". June 2013.

94. McAteer, J., “Solar Oscillations”, Corona Seismology, July 2013.

95. McAteer, J., “The morphology of solar flares”, UKSP, July 2013.

96. McAteer, R. T. J., "The role of magnetic topology in the onset of solar flares", UK NAM, July 2013.

97. Jackiewicz, J., “Red Giants in Eclipsing Binaries”, SDSS-III Collaboration Meeting, Aug 2013.

98. McAteer, R. T. J., "NWRA Flare-Forecasting Comparison Workshops: Goals, Participants, and Methodology", Space Weather Weeks, Boulder and Belgium, Aug 2013.

99. Taylor, G., Rimmelle, T., McAteer, J. “An adaptive optics system for NSO, SPIE, Aug 2013.

100. McAteer, R. T. J., ISSI Workshop, ISSI, Switzerland, "The Search for Units: A Gradient Distribution route to Multifractality in Solar Magnetic Fields", Invited. Sept 2013.

101. Schonfeld, S., “The Neupert effect”, Tracing Connections, Dec 2013.

102. Schonfeld, S. & McAteer, R. T. J. , AGU, "The source of F10.7 emission". Dec 2013.

103. MacDonald, G. & McAteer, R. T. J., "FarSide Imaging", AGU, Dec 2013.

104. McDonald, S., “SUNRISE granules”, Tracing Connections, Dec 2013.

105. McAteer, R. T. J., "Coronal hole identification", Space Weather Workshop, Boulder, Apr 2014.

106. McAteer, R. T. J., "Multifractals, SOC and Space Weather", Invited. Forum for New Leaders in Space Science, CAS, NAS, May 2014

c. Articles submitted to NASA venues

None

d. Patents and patent applications

None

9) Follow-on grant proposals submitted/funded including funding amounts since our last report

1. McNamara, B. “Measuring the sub-milli-magnitude frequency spectra of pulsating B stars” NASA, $54K, awarded.

2. Jackiewicz, J., “Characterizing the Top of the Red Giant Branch using Kepler Drop-List stars” 2011, NASA, $55K, awarded.

3. McNamara, B. “The structure and global properties of Red Giant Clump stars”, NASA, declined.

4. Guzik, J. “Transition in variable stars: from Solar type to Gamma-Doradous type”, NASA, $58K, awarded.

5. Guzik, J. “A search for hybrid Gamma-Doradus/Delta Scuti pulsating variables, Improving the Statistics” NASA, $58K, awarded.

6. McNamara, B. “Automatic Recognition of Solar Features for Developing Data Driven Prediction Models of Solar Activity and Space Weather,” AFOSR, $47K, awarded.

7. Jackiewicz, J., “A Program to Financially Support Student Attendance at Solar Physics Meetings”, 2010, NASA, $45,000, declined.

8. Jackiewicz, J., “A PAARE Program between NMSU, the NSO, and the AFRL”, 2009, $325,935, NSF, awarded.

9. McNamara, B., “A PAARE Program between NMSU, the NSO, and the AFRL”, 2009, $325,935, NSF, awarded.

10. Cao, H & Jackiewicz, J., “Efficient and Intelligent Management of Solar Data by Utilizing High-Performance Computing Infrastructure and Semantic Knowledge for Data-Intensive Retrieval and Exploration”, NMSU, $50,000, awarded.

11. Guzik, J., “A search for hybrid Gamma Doradus/Delta Scuti pulsating variables-improving the statistics”, NASA, $100,000, awarded.

12. Jackiewicz, J., “Sounding stars with Kepler”, (with PI Joanna Molenda-Zakowics, Univ. of Warsaw) European Union, $3,500,000, 3 years, declined.

13. Jackiewicz, J., “Probing stellar interiors with asteroseismology”, Los Alamos National Laboratory, $215,564, awarded.

14. Jackiewicz,J: ”Automatic recognition of solar features for developing data driven prediction models of solar activity and space weather”, AFOSR, $45,000, awarded.

15. Jackiewicz, J., “MRI consortium: Acquisition of the U.S. contribution to SONG: A global telescope network for asteroseismology and exoplanets”. Co-PI. Jon Hakkila (College of Charleston), NSF, $3,269,000. 3 years, declined.

16. Jackiewicz, J., “The National Solar Observatory’s annual solar physics workshops of the American Astronomical Society”, NSF, $45,000, 3 years, awarded.

17. McAteer, J., ”The Complex Sun”, NASA, $452,000, 3 yrs, declined.

18. McAteer,J., "Adaptive Optics for Solar Physics", NMSU, $44,000, 3 yrs, awarded.

19. Jackiewicz, J., "A Fresh Look at Giant Planet Seismology", 2010, NASA $25K, declined.

20. McAteer, J., "Neutron Monitors for Space Science", NASA, $747,000, 3 yrs , declined.

21. McAteer, J., "Novel Approaches to Understanding Coronal Structures", NASA, $356,000, 3 yrs, declined.

22. McNamara,B., "The structure and global properties of Red Giant Clump stars", NASA, declined.

23. McNamara,B., "Characterizing the top of the Red Giant Branch using Kepler drop-list stars", NASA, $55,203. 1 year, declined.

24. McNamara, B., "New Mexico education center in space science and engineering. Department of Defense, $4,830,302, 5 years, declined.

25. McNamara,B., "Creating a 21st Century Partnership with the National Solar Observatory for Excellence in Solar Physics", AURA/NSF, declined.

26. Boucheron, L. "A database and image processing approach to the management of large image collections", AFRL, declined.

27. Delgado, F., "NM Space Grant Consortium Undergraduate Scholarship", NASA, $5,000, 1 year, awarded.

28. Jackiewicz, J. (CoI), "MRI consortium: Development of the SONG spectrograph and installation on the 1 meter telescope at Apache Point Observatory", NSF, $1,000,000, 3 years, declined.

29. Jackiewicz, J., "Probing the three-dimensional structure of solar supergranulation with local helioseismology", NASA, $90,000, declined.

30. Jackiewicz, J. (CoI), "The influence of sub-surface and surface dynamics on the activity cycle", 2011, NASA, $22,126, awarded.

31. Jackiewicz, J. (CoI), "Developing physics-based procedures for local helioseismology probing sunspots and magnetic regions", 2009, NASA, $2,800,000 (NMSU $101,000), 4 yrs., awarded.

32. Jackiewicz, J., "Influence of tidal forces on solar-like oscillations of red giants in binary systems", NASA, 1 year, declined.

33. Jackiewicz, J., “Investigating the pulsation characteristics of hot variable stars”, NASA, 1 year, declined.

34. Jackiewicz, J. (CoI), “Kepler gamma Doradus and delta Scuti stars: Filling the Gaps”, NASA, 1 year, declined.

35. McAteer, J., "Solar Terrestrial Observations and Relations Monitor (STORM)", DoD, $429,000, declined.

36. McAteer, J., "Novel Approaches to Understanding Coronal Structure", NASA, $103,000, declined.

37. McAteer, J., “Neutron Monitors for New Mexico”, NASA, $749,000, declined.

38. McAteer, J., "Contemplating Coronal Complexity", NASA, $120,000, declined.

39. McAteer, J. (CoI), "Photospheric properties of flaring vs. flare-quiet active regions: can we use HMI vector magnetogram sequences to quantify, when and why does the Sun go boom?”, NASA, $546,000 (NMSU $50,187), awarded.

40. McAteer, J. (CoI), “MRI: Development of an Adaptive Optics System for Solar Stellar Observations”, NSF, $1,462,000, declined.

41. McAteer, J., "Rapid Flare Dynamics in the Chromosphere”, NASA, $371,000, declined.

42. McAteer, J., " Student travel fund", NASA, $20,000K, declined.

43. McNamara, B., “Spotted B-stars: Exploring a newly discovered magnetic B star phenomena”, NASA. 1 year, awarded Kepler targets, declined.

44. McNamara, B., “A comprehensive study of the star-burst cluster NGC 3603”, NASA, declined.

45. McNamara, B., “A targeted search for intermediate mass black holes in two promising clusters”, NASA, declined.

46. McAteer, J., “Oscillations in the Solar Corona”; NASA, Total project amount requested: $376,859; 2013-2016, awarded.

47. McAteer J., “Photospheric properties of flaring vs. flare-quiet active regions”, NASA, Total project amount requested: $546,051; 2013-2016, awarded.

48. McAteer, J., “Solar Dynamics Observatory Oscillations module”; Harvard Smithsonian (sub. from NASA); Total project amount requested: $40,000; 2011-2014, awarded.

49. McAteer, J., “The physical connection of flares and oscillations”, NASA, Total project amount requested: $346,980; 2014-2017, pending.

50. McAteer, J., “The energy balance in solar active regions”, NASA, Total project amount requested: $383,989; 2014-2017, pending.

51. McAteer, J., “Multi-Wavelength Observations and Models of Compact Flare Dynamics and Evolution”, NASA, Total project amount requested: $408,323; 2014-2017, declined.

52. McNamara, B., “The Initial Mass Function of NGC 3603”, Hubble Space Telescope Cycle 21, Agency: NASA, Submission data: March 1, 2013, Total project amount requested: n/a, declined.

53. McNamara, B., “A Targeted Search for Intermediate Mass Black Holes”, Hubble Space Telescope Cycle 21, Agency: NASA, Submission data: March 1, 2013, Total project amount requested: n/a, declined.

54. Schonfeld, S.,”AFRL Space Scholars Program”, AFOSR, Submission date: February 2013, Total project amount requested, $11,000, awarded.

55. MacDonald, G., ”AFRL Space Scholars Program ”, AFOSR, Submission date: February 2013, Total project amount requested, $7,000, awarded.

56. Rawls, M. , “NMSGC Fellowship”, NASA, Submission date Fall 2012, Total project amount requested, $10,000, awarded.

57. Andic, A, “The physical connection of flares and oscillations”,NASA, Total project amount requested $346,980, declined.

58. Andic, A, “Connection between photosphere and chromosphere”, NASA, Total project amount requested: $192,756; declined.

59. Andic, A, “ Mapping the magnetic canopy in the chromosphere with short period oscillations”, NASA, Total project amount requested $350,000, declined.

60. Boucheron, L, McAteer, J., Jackiewicz, J., & Pevtson, A. “An Exploration of Active Region Evolution Using SDO and Probabilistic Regression”, NASA, 2013, Total project amount requested: $486,000, declined.

61. Boucheron, L, “An Exploration of Active Region Evolution Using STEREO and SDO”, NASA, Submission date: May 18, 2012 Total project amount requested: $405,000, declined.

62. Cao, H., “Foundations of Large Scale Knowledge and Reasoning Systems”, NSF, Submission date: June 2012, Total project amount requested: $746,933, declined.

63. Gaulme, P., “Cloud physics and mesoscale waves as probes of Jupiters interior”, Institute of Geophysics and Planetary Physics (IGPP) University/Laboratory collaborative research Agency: Los Alamos National Laboratory, Submission date: April 1, 2013 Total project amount requested: $294,638, declined.

64. Gaulme, P., “Systematic modeling of transits and phase effects from light curves of transiting exoplanets and eclipsing binary stars Program”, NASA, March 1, 2013 Total project amount requested: $257,418, declined.

65. Gaulme, P., “Testing Asteroseismology with direct measurements of stellar mass and/or radius in eclipsing binary and multiple-star systems”, NASA, Submission date: January 18, 2013 Total project amount requested: $56,248, declined.

66. Jackiewicz, J., “Analysis of pulsating red-giant stars in eclipsing binaries for precision astrophysics experiments with Kepler”, NASA, Submission date: May 17, 2013 Total project amount requested: $336,785, awarded.

67. Jackiewicz, J., “Determining the three-dimensional profile of solar supergranulation and its connection to the magnetic network”, NASA, Submission date: May 1, 2013 Total project amount requested: $258,404, declined.

68. Jackiewicz, J., “Imaging the Three-Dimensional Structure of Solar Supergranulation With Local Helioseismology”, NASA, Submission date: February 1, 2013 Total project amount requested: $30,000, declined.

69. Jackiewicz, J., “What Makes B-Stars Tick? Unraveling the Mysteries of Candidate Kepler Binaries”, NASA, Submission date: February 1, 2013, Total project amount requested: $30,000, declined.

70. Jackiewicz, J., “A detailed study of the solar supergranulation profile using local helioseismology and realistic simulations of convection”, NASA, Submission date: May 18, 2012 Total project amount requested: $268,782, declined.

71. Jackiewicz, J. & Mayorga, L., “Create a Model to Reproduce Observed Planetary Transit Effects & Probe Intrinsic Properties of Exoplanets”, NSF Graduate Research Fellowship, Submission date: April 2013, Total project amount requested: $126,000, awarded.

72. McNamara, B., “The Initial Mass Function of NGC 3603”, Hubble Space Telescope Cycle 21, NASA, Submission data: March 1, 2013, Total project amount requested: n/a, declined.

73. McNamara, B., “A Targeted Search for Intermediate Mass Black Holes”, Hubble Space Telescope Cycle 21, NASA, Submission data: March 1, 2013, Total project amount requested: n/a, declined.

74. Schonfeld, S.,"AFRL Space Scholars Program", AFOSR, Submission date: February 2014, Total project amount requested, $11,000, awarded.

75. MacDonald, G., "AFRL Space Scholars Program ", AFOSR, Submission date: February 2014, Total project amount requested, $7,000, awarded.

76. McAteer, R. T. J. (Principal), NSF, "CAREER: INSPIRE - An INtegrated Solar Physics Program In Research and Education", $750,000, September 2013 - August 2018, awarded.

77. McAteer, R. T. J. (Principal), NASA, "Oscillations in the Solar Corona", NASA, $250,928.00, January 2013 - January 2016, awarded.

78. McAteer, R.T.J, "Filament Eruptions and the Solar Radio F10.7 Flux", AFOSR, $124,516, Sept 2014-Sept 2017, awarded.

79. McAteer, R.T.J., "The New Role of Data Assimilation in Corona and Solar Wind Models", NASA, $90,000, Sept 2014-Sept 2014, awarded.

80. Rawls, M., "NMSGC Fellowship", Agency: NASA, Submission date Fall 2014, Total project amount requested, $10,000, awarded.

81. Schonfeld, S., "NMSGC Fellowship", Agency: NASA, Submission date Fall 2014, Total project amount requested, $10,000, awarded.

82. McAteer, R. T. J. (Principal), "Photospheric Properties of Flaring vs. Flare-Quiet Active Regions: Can We Use HMI Vector Magnetogram Sequences to Quantify, When and Why does the Sun Go Boom?", NASA, $33,058.02, September 24, 2012 - September 23, 2014, awarded.

83. Boucheron, L. E. (Co-Principal), McAteer, R. T. J. (Principal), "The Energy Balance in Solar Active Regions", NASA, $383,989.00, (October 1, 2013 - September 30, 2016), declined.

84. McAteer, R. T. J. (Principal), Sponsored Research, "Developing Insight into Space Weather Events through Observation Motivated Modeling HAO", High Altitude Obervatory, Total Award: $100,000.00, January 1, 2014 - December 31, 2017, pending.

85. McAteer, R. T. J. (Principal), Sponsored Research, "RUI: ATI: Development of an Adaptive Optics Coronagraph System", NSF, Total Award: $126,180.50, June 1, 2013 - May 31, 2016, pending.

86. McAteer, R. T. J. (Principal), Sponsored Research, "A Workshop to Identify Coronal Holes and How Best to Compare Them with Models", NASA, Total Award: $54,020.00, October 1, 2013 - September 30, 2015, declined

87. Cao, H., “iCREDITS: interdisciplinary Center of Research Excellence in Design of Intelligent Technologies for Smartgrids”, (PI: Enrico Pontelli), NSF, 2013, $4,999,721, awarded.

88. Cao, H., (Co PI), Acquisition of an Instrument for Research in Irregularly Parallel Big Data Computation. (PI: Jonathan Cook), 2013, NSF, $224,074, awarded.

89. McAteer, R. T. J. (Principal), Sponsored Research, "The Variable Sun: Engaging Underrepresented Minority Students in scientific frontiers and controversies", Research Corporation for Science Advancement, Total Award: $75,000.00, February 15, 2014 - February 15, 2017, declined.

90. Gangadharan, V. (Co-Principal), Andic, A. (Principal), McAteer, R. T. J. (Co-Principal), Sponsored Research, "Mapping the Magnetic Canopy in the Chromosphere with Short Period Oscillations", NASA, Total Award: $347,730.00, February 1, 2014 - December 31, 2014, declined.

91. McAteer, R. T. J. (Co-Principal), Jackiewicz, J. (Co-Principal), Boucheron, L. E. (Principal), "An Exploration of Active Region Evolution Using SDO and Probabilistic Regression", NASA, Total Award: $405,856.00, (January 1, 2014 - January 31, 2014), declined.

92. Andic, A. (Principal), McAteer, R. T. J. (Co-Principal), Sponsored Research, "Quantifying the Connection between the Photosphere and the Chromosphere", NASA, Total Award: $192,756.00, (December 16, 2013 - January 31, 2014), declined.

93. Gangadharan, V. (Co-Principal), Andic, A. (Principal), McAteer, R. T. J. (Co-Principal), Sponsored Research, "The Physical Connection of Flares and Oscillations", NASA, Total Award: $346,980.00, (November 1, 2013 - January 31, 2014), declined.

94. Andic, A. (Principal), McAteer, R. T. J. (Co-Principal), Sponsored Research, "Flares, Waves and Energy", NSF, Total Award: $219,677.44, (July 1, 2013 - January 31, 2014), declined.

95. McAteer, R. T. J. (Principal), Sponsored Research, "Multi-Wavelength Observations and Models of Compact Flare Dynamics and Evolution", NASA, Total Award: $168,313.00, December 14, 2013 - December 13, 2016, declined

96. McAteer, R. T. J. (Co-Principal), Jackiewicz, J. (Co-Principal), Boucheron, L. E. (Co-Principal), McNamara, B. J. (Co-Principal), Hynes, P., "New Mexico Data Assimilation for Space Weather", NASA, Total Award: $1,124,994.10, (January 1, 2013 - January 31, 2014), declined.

97. Jackiewicz, J. (Principal), Sponsored Research, "CAREER: New Constraints on the Solar Dynamo Using Helioseismology", NSF, Total Award: $582,503.48, February 15, 2013 - January 31, 2018. Awarded.

98. McNamara, B. “A targeted search for IMBHs in Two Globular Clusters”, NASA HST Cycle 22, request $90K, submitted March 2014, pending.

99. Cao, H., “Small: Aspect-level Influence Discovery from Graphs”, 2014, NSF, $448,245, pending.

100. Cao, H., “Successful Aging and Falls Risk Reduction Center of Biomedical Research Excellence (SAFR-COBRE)”, (PI: Robert Wood), 2014, NIH, $10,800,000, pending.

101. Boucheron, L, “An Exploration of Active Region Evolution Using SDO and Regression Methods”, 2014, NASA, $500,000, pending.

102. MacDonald, G. NASA Graduate Student Fellowship, NASA/NESSF, 2014, $90,000, awarded.

14. Demographic (ethnicity/race and gender through self identification) information on participants (cumulative)

a) Faculty – including demographic data and institutions

Name	Ethnicity	Gender	Institution
Ahluwalia, Hargit	Indian	M	University of New Mexico
Balasubramaniam, K	Indian	M	AFRL
Boucheron, Laura	Anglo	F	New Mexico State University
Cao, Huiping	Asian	F	New Mexico State University
Guzik, Joyce	Anglo	F	Los Alamos National Lab
Jackiewicz, Jason	Anglo	M	New Mexico State University, NSF Career award 2014 Tenured, promoted 2014
McAteer, J	Anglo	M	New Mexico State University NSF Career award 2103
McNamara, B	Anglo	M	New Mexico State University
Rimmile, T	Anglo	M	National Solar Observatory
Voelz, David	Anglo	M	New Mexico State University
Uitenbroek,Han	Anglo	M	National Solar Observatory
Duvall, Tom	Anglo	M	NASA,GSFC

10) Post docs

Aleksandra, Andic	Anglo	F	New Mexico State University
Gangasharan, Vigessh	Anglo	M	New Mexico State University
Patrick Gaulme	Anglo	M	New Mexico State University

11) Graduate and undergraduate students

Name	Ethnicity	Gender	Institution/Awards
Aaziz, Omar	Asian	M	Grad student, NMSU
Al-Ghraibah, Amani	Indian	F	Grad student, NMSU, M.S. 2012, passed Ph.D. qualifying exam 2012
Anderson, Dylan	Anglo	M	Undergrad, NMSU, B.S. 2013
Barberan, CJ	Hispanic	M	Undergrad, NMSU, B.S. 2013
Bassett, Jezreel	Anglo	M	Grad student, NMSU, M.S. 2013
Boberg, Owen	Anglo	M	Undergrad, NMSU, B.S. 2010, Fulbright award 2010
Bornak, Jillian	Anglo	F	Grad Student, NMSU, Ph.D. 2012
Burns, Rose Mary	Hispanic	F	Grad student, transferred to UNM
Calabro, Brandon	Anglo	M	Undergrad, NMSU, B.S. 2012
DeGrave, Kyle	Anglo	M	Grad student, NMSU, passed Ph.D. qualifying exam 2013
Delgado, Fernando	Hispanic	M	Undergrad, NMSU, B.S. 2013, AFRL Fellow 2012, graduated 2014
Hao, Yifan	Asian	M	Grad student, NMSU, M.S. 2013, pass Ph.D. qualifying exam 2013
Kirk, Michael	Anglo	M	Grad student, NMSU, Ph.D. 2013, multi-year AFRL Fellow
MacDonald, Gordon	Anglo	M	Grad student, NMSU, AFRL Fellow 2013, NASA Graduate Fellowship
Madadi, Aditya	Indian	M	Grad student, NMSU
Maldonado, Merceded	Hispanic	F	Undergrad, NMSU, B.S. 2013
Martinez, Monique	Hispanic	F	Undergrad NMSU
Mason, Ashley	Anglo	F	Grad student, NMSU, M.A. 2012
Mayorga, Laura	Hispanic	F	Grad student, NMSU, NSF Graduate Student Fellowship 2013
McKeever, J	Anglo	F	Graduate student, NMSU, passed Ph.D. qualifying exam 2014
Perea, Rose	Hispanic	F	Grad student, NMSU, M.S. 2010
Pham, Robert	Asian	M	Grad Student, NMSU, M.S. 2013
Pevtsov, Alex	Anglo	M	Undergrad, NMSU, B.S. 2012
Ramesh, Eric	Anglo	M	Undergrad, NMSU, B.S. 2013
Rawls, Meredith	Anglo	F	Graduate student, NMSU, NMSGC 2013, 2104 awards
Schonfeld, Sam	Anglo	M	Grad student, NMSU, AFRL Fellow 2013 NMSGC 2014 award
Taylor, Greg	Anglo	M	Grad student, NMSU, NMSU multi-year Fellowship 2011, Ph.D. 2014
To, Son	Asian	M	Grad student, NMSU, Ph.D. 2011
Towry, Amanda	Anglo	F	Undergrad NMSU, B.S. 2012
Valluri, Meghala	Indian	F	Grad student, NMSU, M.S. 2013