Basic Physics with Exotic Millisecond Pulsars

Ransom, S.M.; Andersen, B.; Clifford, N.; Cromartie, H. Thankful; DeCesar, M.E.; Demorest, P.; Fonseca, E.; Freire, P.; Hessels, J.; Lynch, R.S.; Stairs, I.

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pler. Using this framework we find that the most common planet inside the snowline scales with the mass of the central star and it is \( \sim 3-10 \) times less massive than the one outside, as identified via microlensing. By extending the Kepler statistics with RV data, we also find evidence for a drop in the giant planet occurrence rate beyond the snowline. We conclude by discussing the implications of these results on future missions.

**227.06 — The WFIRST Exoplanet Microlensing Survey: Core Science Goals and Predicted Yields**

Matthew Penny

1 Ohio State University (Columbus, Ohio, United States)

One of WFIRST’s primary mission goals is to conduct an exoplanet microlensing survey in the Galactic bulge. The survey will provide a statistical assay of the cold exoplanet population with masses greater than that of Mars and orbits beyond 1 AU, with a total planet yield comparable to Kepler’s. It will also measure the mass function of free-floating planets potentially down into the mass regime of large Kuiper Belt Objects. The WFIRST microlensing survey parameter space spans critical mass and distance scales in planet formation theories, including the ice line, the isolation mass, and the critical mass for runaway gas accretion. I will give an overview of the WFIRST microlensing survey, and highlights of its expected results.

**227.07 — Mu and You: Public Microlensing Analysis Tools and Survey Data**

Savannah Renee Jacklin; Calen Henderson

1 Physics and Astronomy, Vanderbilt University (Nashville, Tennessee, United States)
2 NASA Exoplanet Science Institute, IPAC/Caltech (Pasadena, California, United States)

In the era of big survey astronomy, microlensing is becoming increasingly more accessible to astronomers with a wide variety of backgrounds and expertise. With the advent of public analysis tools, publicly available data, and a multi-tiered data challenge, it is now possible for any interested scientist to find, analyze, and derive physical properties for microlensing events. This is accomplished via a coder’s choice of open source microlensing modeling codes, including MuLensModel, PyLIMA, MuLAN, and VBBinaryLensing. These public software tools allow users to fit microlensing light curves and derive the physical quantities of lens systems. These analysis codes are complemented by the release of the first public microlensing survey data sets. In particular, all data from the near-infrared and ongoing UKIRT microlensing survey of the Galactic bulge spanning 2015-2018 are now publicly available via the NASA Exoplanet Archive. Finally, as part of the 2018 Microlensing Data Science challenge, a Jupyter notebook has been created to facilitate interaction with MuLensModel, PyLIMA, and MuLAN in a user-friendly python-based package. The goal of this challenge is to increase the number and diversity of experts to the field of gravitational microlensing, and to recruit scientists with fresh ideas in anticipation of and preparation for WFIRST.

**228 — Frontiers of Pulsar Astrophyics**

**228.01 — Illuminating a New Population of Rotation-Powered Pulsars**

Elizabeth Ferrara

1 Astronomy, University of Maryland (Greenbelt, Maryland, United States)
2 NASA Goddard Space Flight Center (Greenbelt, Maryland, United States)

The launch of the Fermi Gamma-ray Space Telescope in 2008 provided pulsar astronomers a powerful tool in their hunt for new pulsars. Now, a decade later, we can see how the pulsar population landscape has been changed. The past ten years have witnessed dedicated partnerships of gamma-ray researchers with radio pulsar astronomers, leading to the discovery of several unexpected new classes of pulsars. In addition, powerful new computing algorithms have unveiled many more pulsars not seen outside the gamma-ray regime. We discuss these discoveries, and how regular monitoring of the gamma-ray sky has changed our understanding of both the physics of pulsars and their intrinsic populations.

**228.02 — Basic Physics with Exotic Millisecond Pulsars**

Scott M. Ransom

1 NRAO (Charlottesville, Virginia, United States)
2 University of Virginia (Charlottesville, Virginia, United States)
3 McGill University (Montreal, Quebec, Canada)
4 Lafayette College (Easton, Pennsylvania, United States)
5 MPIfR (Bonn, Germany)
6 University of Amsterdam (Amsterdam, Netherlands)
Some of the highest profile, and highest impact, results from pulsar timing involve probing the high-density physics at the cores of the neutron stars or testing general relativity in new and better ways. These efforts almost always involve the rarest and most exotic of recycled binary systems, including those which formed in unusual ways, or those whose orbits or companions were altered later, as often happens in globular clusters. We report recent results, using timing and search observations from the GBT and Arecibo, on several of these exotic systems. We have new and potentially exciting neutron star mass measurements and new tests of general relativity. And we suggest that it is well worth the efforts involved to uncover and examine these “1%” pulsar systems.

228.03 — Testing General Relativity Using a Pulsar in a Triple System

Anne Archibald1,6; Nina Gusinskaia1; Jason Hessels1,6; Adam Deller7; David Kaplan7; Duncan Lorimer4; Ryan S. Lynch3; Scott M. Ransom3; Ingrid Stairs2
1 Anton Pannekoek Institute, Universiteit van Amsterdam (Amsterdam, Netherlands)
2 University of British Columbia (Vancouver, British Columbia, Canada)
3 NRAO (Charlottesville, Virginia, United States)
4 University of Wisconsin-Milwaukee (Milwaukee, Wisconsin, United States)
5 University of Wisconsin-Milwaukee (Milwaukee, Wisconsin, United States)
6 ASTRON (Dwingeloo, Netherlands)
7 Swinburne University of Technology, (Hawthorn, Victoria, Australia)

The millisecond pulsar PSR J0337+1715 is in a 1.6-day orbit with an inner white dwarf companion, and the pair is in a 327-day orbit with an outer white dwarf companion. This hierarchical triple provides an excellent laboratory to test a key idea of Einstein’s theory of gravity, the strong equivalence principle (SEP): do all objects, even those with strong gravity like neutron stars, fall the same way in the same gravitational field? Almost all alternative theories of gravity predict violations of the SEP at some level. We have carried out an intensive program of timing this pulsar, and we are able to perform a very sensitive test of the SEP. I will discuss our methods, our result, and its theoretical implications.

228.05 — Current results and future prospects from PSR J1757-1854, a highly-relativistic double neutron star binary.

Andrew David Cameron1,2; David Champion2; Michael Kramer2,3; Matthew Bailes4,5; Vishnu Balakrishnan2; Ewan Barr2; Cees Basse6; Shivani Bhandari1; Ramesh Bhat7; Marta Burgay3; Sarah Burke-Spolaor9,10; Ralph Eatough2; Chris Flynn4; Paulo Freire2; Andrew Jameson4; Simon Johnston1; Ramesh Karuppusamy2; Michael Keith1; Lisa S. Levin1; Duncan Lorimer8; Andrew Lyne3; Maura McLaughlin7; Cherry Ng9; Emily Petroff6; Nihan Pol7; Andrea Possenti8; Alessandro Ridolfi2; Ben Stappers3; Willem van Straten12,4; Thomas Tuutari13,2; Caterina Tiburzi14,2; Norbert Wex2
1 CSIRO Astronomy and Space Science (Marsfield, New South Wales, Australia)
2 Center for Gravitational Waves and Cosmology, West Virginia University (Morgantown, West Virginia, United States)
3 Dunlap Institute, University of Toronto (Toronto, Ontario, Canada)
4 Institute for Radio Astronomy & Space Research, Auckland University of Technology (Auckland, New Zealand)
5 Argelander-Institut fuer Astronomie, Universitaet Bonn (Bonn, NRW, Germany)
6 Fakultat fuer Physik, Universitaet Bielefeld (Bielefeld, NRW, Germany)