

## WILLIAM JON MERLINE (2014 June)

### EDUCATION

- Ph.D. Planetary Sciences, University of Arizona, 1995  
Ph.D. minor: Physics  
Dissertation title: *Observations of Small-Amplitude Oscillations in the Radial Velocity of Arcturus*  
Dissertation director: Dr. Robert S. McMillan
- B.S. Physics and Astronomy, University of Wisconsin - Madison, 1978  
Mathematics, University of Wisconsin - Madison, 1978

### BRIEF BIOGRAPHY

Dr. Merline is Principal Investigator of programs, funded by NASA and NSF, to perform a ground-based search for asteroid satellites and asteroid sizes/shapes/poles. The programs employ the relatively new technology of adaptive optics to reduce the blurring caused by the Earth's atmosphere. Dr. Merline led this international team in the first-ever discovery of an asteroid satellite from the Earth (ground-based or HST), (45) Eugenia in 1998. Subsequently, the team discovered the first double asteroid (90) Antiope, the first Trojan binary (617) Patroclus, the first satellites around M- and E-type asteroids, the most loosely bound of any binary of any type, 6 of the 7 known loosely-bound main-belt binaries, and the largest mass-ratio binary; in all, the team has discovered 16 of the 28 known main-belt or Trojan binaries that have been discovered by imaging. He also participated in the discovery of Ida/Dactyl and 3 of the 4 new moons of Pluto, and recently accomplished the first-ever optical imaging of a binary near-Earth asteroid, the first well-resolved imaging of an NEA, and discovery of the triple asteroid (2577), the first binary/multiple of any type to be predicted before discovery. He has led several HST imaging/spectral investigations of satellites. He also led a project under NASA's Applied Information Systems Program to develop artificial-intelligence tools for crater detection and analysis as well as another AIS project to optimize large-scale numerical simulations using active learning. He worked with JPL on a project to produce an on-board software technology-demonstration, using artificial intelligence, to automate, among other tasks, a search for asteroid satellites on future spacecraft missions. The method was applied to NEAR (Near-Earth Asteroid Rendezvous) images of asteroid Eros. He was an Associate Member of the Imaging & Near-Infrared Spectrometer Team of the NEAR spacecraft mission. He had the prime responsibility for the search for satellites of asteroid Mathilde using NEAR images, and during the 1999 flyby and 2000 orbital tour of Eros. He was also an associate of the imaging team of the Galileo mission. He (with C. Chapman) had the prime responsibility for planning and analysis of the Galileo imaging data of the S-L 9 collision with Jupiter, the only direct images of the actual impacts. He assisted in the determination of the orbit and density of Dactyl, the first asteroid moon known and in the search for additional satellites of Ida and Gaspra from Galileo data. He was funded under NASA's NEAR Data Analysis Program to reanalyze the NEAR and Galileo data for asteroid moons. He now participates in NASA's MESSENGER Mission on which he is leading (with Clark Chapman) a search for vulcanoids and satellites of Mercury. His work also involves study of the geology of Mercury, asteroids, and the Galilean satellites through the record of craters and boulders. During his Ph.D. dissertation work, he helped design, build, test, calibrate, and operate a spectrometer designed for extreme sensitivity to small changes in the radial velocities of stars. This instrument was one of the first systems to search for planets around other stars by the radial-velocity, the method that was first used to find extrasolar planets. Dr. Merline used this instrument to discover and show that oscillations in the K-giant Arcturus are analogous to solar acoustic oscillations, effectively leading to a new class of variable stars. He has also produced a software simulator of CCDs and has done work on optimization of CCD photometry and of spectroscopic observations for radial velocity measurement.

### POSITIONS

- 2012-present Staff Scientist, **Southwest Research Institute**, Boulder, CO  
2002-2012 Principal Scientist, **Southwest Research Institute**, Boulder, CO  
1998-2002 Senior Research Scientist, **Southwest Research Institute**, Boulder, CO  
1997-1998 Research Scientist, **Southwest Research Institute**, Boulder, CO  
1996-1997 Postdoctoral Researcher, **Southwest Research Institute**, Boulder, CO

### PROFESSIONAL ACTIVITIES, HONORS, & AWARDS

**Member:** International Astronomical Union (IAU), American Astronomical Society (AAS), Division for Planetary Sciences (DPS) of the AAS, Solar Physics Division of the AAS, American Geophysical Union, Meteoritical Society, Planetary Society

Principal Investigator of multiple NASA/NSF/HST/Spitzer grants, Co-I of multiple NASA/NSF/HST/Spitzer grants  
Service on NASA Planetary Geology & Geophysics Review Panel; HST( Solar System / Extrasolar Planet) Review Panel; External reviewer NASA's Lunar & Asteroid Data Analysis Program, Planetary Astronomy Program, Mars Data Analysis Progra; NOAO telescope allocation committee (solar system / extrasolar planet panel)

Multiple awards of time on large telescopes: Keck, VLT, Gemini N, Gemini S, HST, Spitzer, CFHT, IRTF, Palomar 200", Mt. Wilson 100"

Asteroid 7607 Billmerline named in his honor

NASA Software Award, 2012, "SIM\_LEARN: Software for Directed Exploration of Complex Systems"

NASA Certificate of Recognition, 2006, "Automated Knowledge Discovery from Simulators"

NASA Group Achievement Award, 2002, "NEAR-Shoemaker Mission Team: First Rendezvous, Orbit, and Landing on an Asteroid"

NASA Certificate of Recognition, 1999, "Technically Significant Software: Satellite Detector"

NASA Certificate of Recognition, 1998, "Technically Significant Software: Onboard UV Spectral Analyzer"

## SELECTED PUBLICATIONS

- Merline, W.J., Tamblyn, P.M., Warner, B.D., Pravec, P., Tamblyn, J.P., Neyman, C., Conrad, A.R., Owen, W.M., Carry, B., Drummond, J.D., Chapman, C.R., Enke, B.L., Grundy, W.M., Veillet, C., Porter, S.B., Arcidiacono, C., Christou, J.C., Durda, D.D., Harris, A.W., Weaver, H.A., Dumas, C., Terrell, D., Maley, P. "S/2012 (2577) 1", *IAU Circ.* **9267**, 1 (2013).
- Merline, W.J., Carry, B., Conrad, A.R., Owen, W.M., Drummond, J.D., Vachier, F., Tamblyn, P.M., Dumas, C., Chapman, C.R., Christou, J.C., Durda, D.D., Enke, B.L. "Discovery and Orbit of an Extreme Mass-Ratio Satellite of Asteroid (41) Daphne in a Close Orbit", *Icarus*, expected submission August 2014 (2014).
- Carry, B., Kaasalainen, M., Merline, W.J., Durech, J., Conrad, A., Drummond, J.D., Tamblyn, P.M., Berthier, J., Behrend, R., Bernasconi, L., Frappa, E., Chapman, C.R., Dumas, C. "The Resolved Asteroid Program: The irregular shape of (41) Daphne", *Icarus*, expected submission August 2014 (2014).
- Drummond, J.D., Carry, B., Merline, W.J., Dumas, C., Hammel, H., Erard, S., Conrad, A., Tamblyn, P., Chapman, C.R. "Dwarf Planet Ceres: Ellipsoid Dimensions and Rotational Pole from Keck and VLT Adaptive Optics Images", *Icarus* **236**, 28 (2014).
- Merline, W.J., Drummond, J.D., Carry, B., Conrad, A., Tamblyn, P.M., Dumas, C., Kaasalainen, M., Erikson, A., Mottola, S., Durech, J., Rousseau, G., Behrend, R., Casalnuovo, G.B., Chinaglia, B., Christou, J.C., Chapman, C.R., Neyman, C. "The Resolved Asteroid Program – Size, shape, and pole of (52) Europa", *Icarus* **225**, 794 (2013).
- Conrad, A.R., Merline, W.J., La Camera, A., Boccacci, P., Bertero, M., Herbst, T.M., Kuerster, M., Carry, B., Drummond, J., Norris, M., Christou, J.C. "Detecting Asteroid Satellites with LINC-NIRVANA at the Large Binocular Telescope, *Proc. LPSC* **44**, 2032 (2013).
- Carry, B., Kaasalainen, M., Merline, W.J., Muller, T.G., Jorda, L., Drummond, J.D., Berthier, J., O'Rourke, L., Durech, J., Kuppers, M., Conrad, A., Tamblyn, P., Dumas, C., Sierks, H., OSIRIS Team. "Shape modeling technique KOALA validated by ESA Rosetta at (21) Lutetia", *Planetary & Space Sci.* **66**, 200 (2012).
- Merline, W.J., Drummond, J.D., Tamblyn, P.M., Carry, B., Neyman, C., Conrad, A.R., Chapman, C.R., Christou, J.C., Dumas, C., Enke, B.L. "2005 YU 55" (first well-resolved imaging of an NEO), *IAU Circ.* **9242**, 1 (2011).
- Merline, W.J., Drummond, J.D., Tamblyn, P.M., Neyman, C., Carry, B., Conrad, A.R., Chapman, C.R., Christou, J.C., Dumas, C., Enke, B.L. "Keck adaptive-optics imaging of Near-Earth Asteroid 2005\_YU55 during its 2011 close flyby", *ACM 2012 Japan*, paper 6372 (2012).
- Carry, B., Vernazza, P., Dumas, C., Merline, W.J., Mousis, O., Rousselot, P., Jehin, E., Manfroid, J., Fulchignoni, M., Zucconi, J.-M. "The remarkable surface heterogeneity of the Dawn mission target (1) Ceres", *Icarus* **217**, 20 (2012).
- Showalter, M.R., Weaver, H.A., Stern, S.A., Steffl, A.J., Buie, M.W., Merline, W.J., Mutchler, M.J., Soummer, R., Throop, H.B. "New Satellite of (134340) Pluto: S/2012 (134340) 1", *IAU Circ.* **9253**, 1 (2012).
- Merline, W.J., Weaver, H.A., Tamblyn, P.M., Neyman, C., Stern, S.A., Carry, B., Spencer, J.R., Conrad, A.R., Showalter, M.A., Olkin, C.B., Steffl, A.J., Sheppard, S.S., Buie, M.W., Enke, B.L. "A Keck search for faint satellites of Pluto in support of New Horizons", *Bull. AAS* **44**, 30409 (2012).
- Drummond, J.D., Conrad, A., Merline, W.J., Carry, B., Chapman, C.R., Weaver, H.A., Tamblyn, P.M., Christou, J.C., Dumas, C. "Physical properties of the ESA Rosetta target asteroid (21) Lutetia. I. The triaxial ellipsoid dimensions, rotational pole, and bulk density", *Astron. & Astrophys.* **523**, A93 (2010).
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- Weaver, H.A., Feldman, P.D., Merline, W.J., Mutchler, M.J., A'Hearn, M.F., Bertaux, J.-L., Feaga, L.M., Parker, J.W., Slater, D.C., Steffl, A.J., Chapman, C.R., Drummond, J.D., Stern, S.A. "Ultraviolet and visible photometry of asteroid (21) Lutetia using the Hubble Space Telescope", *Astron. & Astrophys.* **518**, A4 (2010).
- Carry, B., Dumas, C., Kaasalainen, M., Berthier, J., Merline, W.J., Erard, S., Conrad, A., Drummond, J.D., Hestroffer, D., Fulchignoni, M., Fusco, T. "Physical properties of (2) Pallas", *Icarus* **205**, 460 (2010).
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- Carry, B., Dumas, C., Fulchignoni, M., Merline, W., Berthier, J., Hestroffer, D., Fusco, T., Tamblyn, P. "Near-infrared mapping and physical properties of asteroid 1 Ceres", *Astron. & Astrophys.* **478**, 235 (2008).
- Merline, W.J., Conrad, A.R., Drummond, J.D., Carry, B., Dumas, C., Tamblyn, P.M., Chapman, C.R., Owen, W.M., Durda, D.D., Campbell, R.D., Goodrich, R.W. "Discovery of an extreme mass-ratio satellite of (41) Daphne in a close orbit", *Proc. ACM 2008, LPI Contrib* 1405, 8370 (2008).
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- Weaver, H.A., Stern, S.A., Mutchler, M.J., Steffl, A.J., Buie, M.W., Merline, W.J., Spencer, J.R., Young, E.F., Young, L.A. "Discovery of two new satellites of Pluto", *Nature* **439**, 943 (2006).
- Merline, W.J., Weidenschilling, S.J., Durda, D.D., Margot, J.L., Pravec, P., Storrs, A.D. "Asteroids Do Have Satellites", in *Asteroids III*, eds. W.F. Bottke, A. Cellino, P. Paolicchi, & R.P. Binzel, Univ. of Arizona Press, pp 289-312 (2002).
- Merline, W.J., Close, L.M., Dumas, C., Chapman, C.R., Roddier, F., Menard, F., Slater, D.C., Duvert, G., Shelton, C., Morgan, T. "Discovery of a moon orbiting the asteroid 45 Eugenia", *Nature* **401**, 565 (1999).

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Merline, W.J., Tamblyn, P.M., Dumas, C., Menard, F., Close, L.M., Chapman, C.R., Duvert, G., Ageorges, N. "S/2004 (4764) 1", *IAU Circular* **8297**, 1 (2004).

Tamblyn, P.M., Merline, W.J., Chapman, C.R., Nesvorny, D., Durda, D.D., Dumas, C., Storrs, A.D., Close, L.M., Menard, F. "S/2004 (17246) 1", *IAU Circular* **8293**, 3 (2004).

Merline, W.J., Tamblyn, P.M., Chapman, C.R., Nesvorny, D., Durda, D.D., Storrs, A.D., Close, L.M., Menard, F. "S/2003 (22899) 1", *IAU Circular* **8232**, 2 (2003).

Carry, B., Dumas, C., Fulchignoni, M., Fusco, T., Merline, W. "Near-infrared mapping of Ceres surface from Keck", *Bull. AAS* **38**, 6806 (2006).

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Durda, D.D., Bottke, W.F., Nesvorny, D., Enke, B.L., Merline, W.J., Asphaug, E., Richardson, D.C., Leinhardt, Z.M. "The formation of asteroid satellites in large impacts: results from numerical simulations", *Icarus* **170**, 243 (2004).

Drummond, J., Merline, W.J., Conrad, A., Christou, J., Tamblyn, P., Carry, B. "Asteroid (19) Fortuna: Triaxial ellipsoid dimensions and rotational pole with AO at Gemini North", *EPSC/DPS 2011*, paper 1426 (2011).

Carry, B., Kaasalainen, M., Merline, W.J., Drummond, J.D., Durech, J., Berthier, J., Conrad, A. "KOALA: 3-D shape of asteroids from multi-data inversion", *EPSC/DPS 2011*, paper 490 (2011).

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