

## **Linda Siobhan Sparke**

Washburn Observatory                      Telephone: (608) 262-0309 or 3071  
University of Wisconsin-Madison        sparke@astro.wisc.edu  
475 North Charter Street                Fax: (608) 263-6386  
Madison, Wisconsin 53706

### Citizenship:

Dual citizenship: United States of America, United Kingdom (Britain).

### Education:

New Hall, Cambridge University, UK.

B.A. with First Class Honours in the Mathematical Tripos, June 1977

University of California at Berkeley, M.A. in Astronomy, June 1979.

Ph.D. June 1981: 'Swirling Gas Flows in Elliptical Galaxies': Advisor: Frank H. Shu

### Research Areas:

- dynamics of galaxies, particularly disk systems
- dynamics of disks around binary stars
- structure, stellar populations and gas distribution in galaxies

Elected to Fellowship of the American Physical Society, 2002

### Languages:

Speaking, writing and reading knowledge of Dutch (once fluent) and German. Can read Afrikaans, based on its similarity to Dutch. Enough knowledge of French, Italian and Spanish to follow the general meaning of a document, with some speaking and writing.

### Research Employment:

Professor of Astronomy, University of Wisconsin-Madison, August 1997—present.

Associate Professor, University of Wisconsin-Madison, August 1992—August 1997.

Assistant Professor, University of Wisconsin-Madison, January 1989—August 1992.

Sabbatical Leaves: September—December 1996 at the Kapteyn Astronomical Institute, Groningen, Netherlands; January—May 1997 at Mt. Stromlo Observatory, Australian National University, Canberra. August—December 2004, Dominion Astrophysical Observatory, Canada; January—June 2005, Max Planck Institute for Astrophysics, Garching, Germany.

Visitor at the Scuola Normale Superiore, Pisa, Italy, Sept—Dec 1988.

Postdoctoral Fellow at the Kapteyn Laboratory, Groningen, Netherlands, Oct 1985—Aug 1988.

Postdoctoral Fellow at the Institute of Astronomy, Cambridge, U.K.,  
September 1981—September 1982, and January 1984—September 1985.

Research Fellow in Astronomy at New Hall, Cambridge University, Oct 1981—Oct 1985.

Member, Institute for Advanced Study at Princeton: September 1982—December 1983.

### **Committees and Service:**

Scientific Editor, *Astrophysical Journal* (January 2002—December 2004)

Chair, Department of Astronomy, University of Wisconsin-Madison (July 2001—June 2004)

UW-Madison representative for Associated Universities for Research in Astronomy (from July 2005); this organization runs the US national facilities for optical astronomy, and the Space Telescope Science Institute.

Co-organizer for the American Astronomical Society's Fall 2004 and Fall 2006 meetings for Department and Program Chairs.

Member of WIYN Board (April 2000—Fall 2005); this consortium (UW-Madison, U. Indiana, Yale and the National Optical Astronomical Observatory) operates a 3.5 meter telescope on Kitt Peak mountain in Arizona.

Panel member for review of Lowell Observatory, Flagstaff, AZ: October 2005.

Member of Scientific Organizing Committee and conference summarizer for VLA 20th Anniversary meeting on 'Gas and Galaxy Evolution', Socorro, New Mexico, May 2000; Member of Scientific Organizing Committee for 'Discs of Galaxies: Kinematics, Dynamics and Perturbations', Puebla, Mexico, November 2001, and for 'Dynamics of Galaxies' in memory of G.G. Kuzmin, at Pulkovo Observatory, St Petersburg, August 2007.

Member of proposal review panels for NSF's Extragalactic program, NASA Long Term Space Astrophysics and Astrophysics Theory Program, Hubble Space Telescope, Very Large Array, Science Foundation Ireland; mail reviews for ZWO (Netherlands).

American Astronomical Society's George van Biesbroeck Prize committee (2004—present)

Executive Committee, Physical Sciences Division, UW-Madison (1995-8) — this committee reviews tenure cases.

Vilas Associate (internal UW-Madison faculty award) 1996-8.

PI for NSF-funded summer Research Experiences for Undergraduates program, run jointly with the Astrophysics group in the Physics department. Over the 5 years 2002—6 we have brought 54 students to Madison, successfully recruiting members of under-represented minority groups (40% of our participants) and women (50%). Bob Benjamin, the first Program Director, found this experience useful in securing a faculty job at UW Whitewater; Dr. Edwin Mierkiewicz is now the Program Director. They, with Prof. Eric Wilcots and Dr. Keivan Stassun, are responsible for our success in recruiting members of under-represented groups.

### **Training as Department Chair:**

CCAS (Council of Colleges of Arts and Sciences) seminar for new Department Chairs, July 12-14, 2001; San Diego, CA.

Big-10 CIC Academic Leadership Program, 2001-2. This involved 3 two-day meetings of all participants (five from each of 10 public universities, mainly in the Midwest) and several hour-long meetings of Wisconsin participants with UW-Madison campus leaders.

Participant and Panelist, CIC Department Executive Officer seminar, April 1-3, 2004; Chicago.

### **Service as Department Chair, 2001-4:**

Co-organized the American Astronomical Society's meeting for Department and Program Chairs in Fall 2004

Inaugurated department's Board of Visitors, to assist with private fundraising.

Leadership in management and development for Space Place, our off-campus outreach center with 2.1FTE in underserved South Madison. The Provost's office funded a move to nearby enlarged and refurbished space, completed in August 2005. Worked with Space Place director Dr. Jim Lattis to set up our first web-based distance-learning astronomy course, aimed at K-12 teachers.

Prepared the self-study for our department's 15-year program review.

Handled 2 faculty hires: a spousal hire of Professor Ellen Zweibel, and hire as Assistant Professor (from Fall 2005) of Andrew Sheinis, specialist in astronomical instrumentation.

Promotions to tenure for Alex Lazarian (Reynolds, Savage and Zweibel prepared the package) and Amy Barger (Bershady, Gallagher and Wilcots prepared the package).

### **Book publication:**

Text for 3rd and 4th year undergraduate students: L.S. Sparke and J.S. Gallagher (2000) 'Galaxies in the Universe: An Introduction', published by Cambridge University Press. The first edition sold about 7000 copies; the second edition will appear in February 2007.

L.S. Sparke (2004) 'Warps, Polar Rings and High-Velocity Clouds' (2004), 24-page chapter in High Velocity Clouds, eds. H. van Woerden, U. Schwarz, & B. Wakker; Astrophysics and Space Science Library Volume 312 (Kluwer, Netherlands).

### **Postdoctoral Scientist advised:**

Barbara Pichardo (PhD UNAM, Mexico; now on the staff at UNAM) used the 'invariant loop' method (see below) to find gas orbits in circumstellar and circumbinary disks around members of a binary in an eccentric orbit. This new technique can be used in binary systems with arbitrarily high eccentricity.

### **Ph.D. Students advised:**

Stephen E. Levine (Ph.D. Dec. 1992; staff astronomer at U.S. Naval Observatory, Flagstaff, AZ) used a gravitational N-body code to test the stability of self-consistent equilibrium models for 'perfect elliptical disks.' He developed new methods for choosing the orbits and for placing particles on them uniformly so as to provide a 'quiet start.'

Magda Arnaboldi (Ph.D. Oct. 1992 from SISSA, Trieste; on staff at Torino Observatory, Italy and at ESO, Garching, Germany) worked on optical and UV observations of the polar ring system AM2020-504 and examined the stability of self-gravitating polar rings in a triaxial galaxy potential.

Jo E. Pitesky (Ph.D. May 1993 from U. C. Los Angeles; now at Jet Propulsion Laboratory, Pasadena, CA) looked at warping modes in a galactic model consisting of a thin cold disk, an oblate bulge free to tilt about its center, and a rigid halo potential. She found long-lived modes in which the bulge was tipped away from the plane of the inner disk.

Andrea L. Cox (Ph.D. August 1996; formerly on the faculty at Beloit College, WI; now at Tomotherapy Inc, Madison WI) used the VLA radio telescope to map polar ring galaxies in neutral hydrogen, obtaining high-resolution velocity fields for comparison with dynamical models, and searching for diffuse gas around the rings which provides clues to their formation.

Witold Maciejewski (Ph.D. 1998; now on the faculty at Liverpool John Moores University, UK) developed the 'invariant loop' technique to examine orbits in a gravitational potential that varies periodically in time. He used this to study the orbits that gas and stars would follow in 'double-bar' galaxies, as the inner bar turns relative to the main outer bar. The fast-tumbling central bar may be important for feeding gas into the galactic center.

Peter Erwin (Ph.D. 2000; now postdoc at the Max Planck Institute for Extraterrestrial Physics, Garching, Germany) worked on vertical resonances in non-axisymmetric galaxy potentials, including disks around binary stars and 'lopsided' barred galaxies. He used the WIYN telescope for a photometric study of early-type barred galaxies, combining those observations with Hubble Space Telescope archival data to show that central structures such as secondary bars and inner disks are surprisingly common.

Samuel Friedman (current PhD student) is investigating possible orbits for the galaxy M33 moving in the gravitational potential of the Milky Way and M31 with the Local Group assumed to be isolated. Preliminary indications are that this can explain the observed position, radial velocity and proper motion of M33, without requiring external torques.

#### **Other collaborations with graduate students:**

Peter Hofner (Ph.D. 1994; postdoc in Bonn, then in Arecibo; now on the faculty at New Mexico Tech, Socorro, NM) investigated the behavior of a galactic disk in a slightly flattened halo potential following an initial perturbation which warps the disk. The inner parts of the disk settle towards a steadily precessing normal mode of bending, while the outer region twists into a spiral form similar to that observed in the gas disks of spiral galaxies. Our paper was published in 1994.

Greg Howard (MS 1994; left for computing job in San Francisco; now PhD program in public health, Boston U.) searched for periodic orbits in one 'double-bar' galaxy model, which closed after the inner bar had made an integral number of turns relative to the outer bar.

Wesley Colley (Ph.D. 1997, from Princeton University; postdoc at CfA; now on staff at Lincoln Labs, MIT) investigated the motions of gas orbiting in a disk which is tilted away from the symmetry plane of an axisymmetric or triaxial galaxy potential, using a set of 'orbit-averaged' equations to follow the way that the disk settles into an equilibrium state. Our paper appeared in 1996.

Evan Gnam (MS 1997; now physics teacher at East High School, Madison) calculated distribution functions for particles making up the  $n=1$  (spherical exponential) and  $n=1/2$  Sersic models; these are the spherically symmetric density distributions corresponding to the surface brightness observed for dwarf elliptical galaxies. The distribution functions allow us to calculate velocity profiles and velocity dispersions expected for stars at any point in the galaxy.

William Shoemaker (1999-2000; now a science journalist) began reducing optical spectra of gas in polar ring galaxies. He left before finishing MS for an editorial position with Astronomy magazine in Waukesha, WI.

### **Undergraduates supported:**

PI for NSF summer REU site in Astronomy and Astrophysics, 2002-4 and 2004-9.

Chris Trinh (U.C. Berkeley undergraduate, summer 2006) reduced and analyzed multi-color images of polar ring galaxies from the WIYN telescope. He found thin edge-on disks hidden in the central galaxies of two out of his three objects, and presented the work at the AAS meeting in January 2007.

Ben Willett and Cathy Radomski (summer 2002), working with Jay Gallagher, analysed WIYN images of star-forming dwarf galaxies.

Edo Noordermeer (1998-9; 2006 PhD Groningen, Netherlands; now postdoc at Nottingham University, UK). We investigated the orbits that gas would follow in a lopsided galaxy potential. Our paper appeared in 2001.

Nate Bastian (2000-1; 2005 PhD Utrecht, Netherlands; now postdoc at University College London). We applied the 'invariant loop' technique to calculating orbits in gas disks around stars in a binary system. Work subsequently developed further with postdoc Barbara Pichardo.

David Stukel (1990-1) began calculations for orbits in doubly-barred galaxy potentials; project subsequently passed to Greg Howard, then to Witold Maciejewski.

### **Bibliography: Refereed Publications and Invited Conference Papers:**

Andersen, D.R., Bershadsky, M.A., Sparke, L.S., Gallagher, J.S., Wilcots, E.M., van Driel, W. and Monnier-Ragaine, D. (2006) 'The Photometric and Kinematic Structure of Face-on Disk Galaxies. I. Sample Definition, H $\alpha$  Integral Field Spectroscopy, and H I Line Widths', *Astrophysical Journal Supp.* 166, 505.

Iodice, E., Arnaboldi, M., Saglia, R.P., Sparke, L.S., Gerhard, O.E., Gallagher, J.S., Combes, F., Bournaud, F., Capaccioli, M. and Freeman, K.C. (2006) 'High resolution stellar kinematics for the central component of the Polar Ring Galaxy NGC 4650A', *Astrophysical Journal* 643, 200.

Cox, A.L., Sparke, L.S. and van Moorsel, G. (2006) 'Neutral Hydrogen in the Polar-Ring Galaxy UGC 9796', *Astronomical Journal* 131, 828.

Theis, Ch., Sparke, L.S. and Gallagher, J.S. (2006) 'On stability and spiral patterns in polar disks' *Astronomy and Astrophysics* 446, 905.

Hunter, D.A., Rubin, V.C., Swaters, R.A., Sparke, L.S. and Levine, S.E. (2005) 'The Stellar Velocity Dispersion in the Inner 1.3 Disk Scale-Lengths of the Irregular Galaxy NGC 4449', *Astrophysical Journal* 634, 281.

Pichardo, B., Sparke, L.S. and Aguilar, L.A. (2005) 'Circumstellar and circumbinary discs in eccentric stellar binaries' *MNRAS* 359, 521.

Iodice, E., Arnaboldi, M., Sparke, L.S., Buta, R., Freeman, K.C. and Capaccioli, M. (2004) 'Photometric Structure of the peculiar galaxy ESO 235-G58', *Astronomy and Astrophysics* 418, 41.

- Cox, A.L. and Sparke, L.S. (2004) 'Radio Continuum Emission from Polar Ring Galaxies', *Astronomical Journal* 128, 2013.
- Iodice, E., Arnaboldi, M., Bournaud, F., Combes, F., Sparke, L.S., van Driel, W. and Capaccioli, M. (2003) 'Polar Ring Galaxies and the Tully-Fisher Relation: Implications for the Dark Halo Shape', *Astrophysical Journal* 585, 730.
- Erwin, P., & Sparke, L.S. (2003) 'An Imaging Survey of Early-Type Barred Galaxies' (2003) *Astrophysical Journal Supplement* 146, 299.
- Karle, A., and 106 co-authors including L.S. Sparke (2003) 'IceCube - the next generation neutrino telescope at the South Pole', *Nuclear Physics B Proceedings Supplements* 118, 388-395.
- Sparke, L.S. (2002) 'Off-Plane Gas and Galaxy Disks', in 'Discs of Galaxies: Kinematics, Dynamics and Perturbations', eds. E. Athanassoula and A. Bosma, *ASP Conf. Ser.* 275, 367 (invited review).
- Hunter, D.A., Rubin, V.C., Swaters, R.A., Sparke, L.S. and Levine, S.E. (2002) 'The Stellar and Gas Kinematics of Several Irregular Galaxies', *Astrophysical Journal* 580, 194.
- Iodice, E., Arnaboldi, M., Sparke, L.S. and Freeman, K.C. (2002) 'Near-Infrared photometry in the J, H and Kn bands for Polar Ring Galaxies. I. Data, structural parameters', *Astronomy and Astrophysics* 391, 103.
- Iodice, E., Arnaboldi, M., Sparke, L.S. and Freeman, K.C. (2002) 'Near-Infrared photometry in the J, H and Kn bands for Polar Ring Galaxies. II. Global properties', *Astronomy and Astrophysics* 391, 117.
- Erwin, P., & Sparke, L.S. (2002) 'Double Bars, Inner Disks, and Nuclear Rings in Early-Type Disk Galaxies', *Astronomical Journal* 124, 65.
- Sparke, L.S. (2002) 'What can polar rings tell us about the shapes of dark matter halos?' in 'The Shapes of Galaxies and their Dark Halos', ed. P. Natarajan, World Scientific, Singapore, p178.
- W. van Driel, M. Arnaboldi, F. Combes and L.S. Sparke (2002) 'A neutral hydrogen survey of polar ring galaxies. IV. Parkes Observations', *Astronomy and Astrophysics* 386, 140.
- Gallagher, J.S., Sparke, L.S., Matthews, L.D., Frattare, L.M., English, J., Kinney, A.L., Iodice, E. and Arnaboldi, M. (2002) 'Wide Field Planetary Camera 2 Observations of the 'Polar Ring' Galaxy NGC 4650A', *Astrophysical Journal* 568, 199.
- Iodice, E., Arnaboldi, M., De Lucia, G., Gallagher, J.S., Sparke, L.S. and Freeman, K.C. (2002) 'The puzzle of the polar structure in NGC 4650A', *Astronomical Journal* 123, 195.
- Maciejewski, W., Teuben, P.J., Sparke, L.S. and Stone, J.M. (2002) 'Gas inflow in barred galaxies -- effects of secondary bars', *Monthly Notices of the Royal Astronomical Society*, 329, 502.
- E. Noordermeer, L.S. Sparke and S.E. Levine (2001) 'The kinematics of Lopsided Galaxies', *Monthly Notices of the Royal Astronomical Society*, 328, 1064.

L.S. Sparke (2001) 'Conference Summary: Around the Universe in 3.5 Days', in 'Gas and Galaxy Evolution', eds. J. Hibbard, M. Rupen and J. van Gorkom, ASP Conference Series 240, p649.

Andersen, D.R., Bershady, M.A., Sparke, L.S., Gallagher, J.S. III and Wilcots, E.M. (2001) 'A Measurement of Disk Ellipticity in Nearby Spiral Galaxies', *Astrophysical Journal (Letters)*, 551, L131.

A.L. Cox, L.S. Sparke, A.M. Watson & G. van Moorsel (2001) 'Stars and Gas in the Galaxy Pair II Zw 70/71', *Astronomical Journal* 121, 692.

W. Maciejewski and L.S. Sparke (2001) 'Orbits Supporting Bars within Bars', *Monthly Notices of the Royal Astronomical Society* 313, 745.

L.S. Sparke and A.L. Cox (2000) 'New Observations of Polar Ring Galaxies', in 'Dynamics of Galaxies', ASP Conference Series 197, p. 119.

W. van Driel, M. Arnaboldi, F. Combes and L.S. Sparke (2000) 'A Neutral Hydrogen Survey of Polar Ring Galaxies. III. Nancay Data' *Astronomy and Astrophysics Supplement*, 141, 385.

P. Erwin and L.S. Sparke (1999) 'Vertical Instabilities and Off-Plane Orbits in Circumbinary Disks' *Astrophysical Journal* 521, 798.

P. Erwin and L.S. Sparke (1999) 'Triple Bars and Complex Central Structures in Disk Galaxies' *Astrophysical Journal (Letters)* 521, L37.

S.E. Levine and L.S. Sparke (1998) 'The Stability of 'Perfect Elliptic Disks.' II. A Minimal Streaming Case' *Astrophysical Journal* 503, 125.

I. Wanders and others including L.S. Sparke (1997) 'Steps toward Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei. XI. Intensive Monitoring of the Ultraviolet Spectrum of NGC 7469' *Astrophysical Journal Supplement* 113, 69.

P.M. Rodriguez-Pascual and others including L.S. Sparke (1997) 'Steps toward Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei. IX. Ultraviolet Observations of Fairall 9' *Astrophysical Journal Supplement* 110, 9.

S.E. Levine and L.S. Sparke (1998) 'A Model for Lopsided Galactic Disks', *Astrophysical Journal (Letters)*, 496, L13.

W. Maciejewski and L.S. Sparke (1997) 'Regular Orbits and Periodic Loops in Multiply-Barred Galactic Potentials', *Astrophysical Journal (Letters)*, 484, 117.

P.L. Schechter and others including L.S. Sparke (1997) 'The Quadruple Gravitational Lens PG 1115 + 080: Time Delays and Models', *Astrophysical Journal (Letters)*, 475, 85.

G. Galletta, L. Sage and L.S. Sparke (1997) 'Molecular Gas in Polar Ring Galaxies', *Monthly Notices of the Royal Astronomical Society*, 284, 773.

Invited hour-long talk at summer 1996 meeting of the American Astronomical Society, on 'Polar Ring Galaxies'

L.S. Sparke (1996) 'A Dynamical Model for the Warped and Twisted Gas Disk in Centaurus A', *Astrophysical Journal*, 473, 810.

W.N. Colley and L.S. Sparke (1996) 'The Evolution of Viscous Inclined Disks in Axisymmetric and Triaxial Galaxies', *Astrophysical Journal*, 471, 748.

A.L. Cox and L.S. Sparke (1996) 'Using HI in Polar Rings to Probe Galaxy Potentials'; *Minnesota Lectures on Extragalactic Neutral Hydrogen (ASP Conference Series, vol 106)*, ed. E. Skillman, p. 168.

D.M. Crenshaw and others including L.S. Sparke (1996) 'Multi-Wavelength Observations of Short-Timescale Variability in NGC 4151 I. Ultraviolet Observations', *Astrophysical Journal*, 470, 322.

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K.T. Korista and 111 others including L.S. Sparke (1995) 'Steps Towards Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei: VIII An Intensive HST, IUE and Ground-Based Study of NGC 5548', *Astrophysical Journal Supplement*, 97, 285.

A.L. Cox, L.S. Sparke, O. Richter and M.A. Shaw (1995) 'Observations of Warped Disks and Polar Rings in the 21cm Line of Neutral Hydrogen', *Annals of New York Academy of Sciences*, 752, 27.

L.S. Sparke (1995) 'Self-Gravitating Models for Polar Rings', *Annals of New York Academy of Sciences*, 752, 12.

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O.-G. Richter, P.D. Sackett and L.S. Sparke (1994) 'A Neutral Hydrogen Survey of Polar Ring Galaxies: I Green Bank Observations of the Northern Sample', *Astronomical Journal*, 107, 99.

P. Hofner and L.S. Sparke (1994) 'Time-Evolution of Galactic Warps', *Astrophysical Journal*, 428, 466.

G. Reichert and 63 others including L.S. Sparke (1994) 'Steps Towards Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei: V Variability of the Ultraviolet Continuum and Emission Lines of NGC 3783', *Astrophysical Journal*, 425, 582.

L.S. Sparke (1993) 'The Warp of the Milky Way' in 'Back to the Galaxy', eds. S. Holt and F. Verter, p. 447.

L.S. Sparke (1993) 'Does the Inner BLR Dim Down When the Power Turns Up?', *Astrophysical Journal*, 404, 570.

M. Arnaboldi, M. Capaccioli, E. Cappellaro, E.V. Held, and L. Sparke (1993) 'The Polar Ring Galaxy AM2020-504', *Astronomy and Astrophysics*, 267, 21.

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- M. Stiavelli and L.S. Sparke (1991) 'Influence of a Dark Halo on the Stability of Elliptical Galaxies', *Astrophysical Journal*, 382, 466.
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L.S. Sparke and F.H. Shu (1980) 'Why Extended Radio Doubles are Found in Elliptical Galaxies', *Astrophys. J. Letts*, 241, L65.

L.S. Sparke, J. Kormendy and H. Spinrad (1980) 'Spectrophotometry of VII Zw 421 and II Zw 67; S0 Galaxies Dominated by Young Stars', *Astrophys. J.*, 235, 755.

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