Peter Erwin

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Research Interests
Structure, dynamics, and evolution of galaxies: supermassive black holes, nuclear star clusters, and host-galaxy correlations; bulges, pseudobulges, and secular evolution of galaxies; barred and double-barred galaxies; structure and formation of galaxy disks; connections between galaxy morphology, star formation, and environment; statistics in astronomy.

Education
Ph.D.: Department of Astronomy, University of Wisconsin, Madison, Wisconsin, 2000
Thesis: "Non-axisymmetric Dynamics in Binaries and the Centers of Galaxies"
Advisor: Linda S. Sparke

Bachelor of Arts: Wesleyan University, Middletown, Connecticut, 1988
Astronomy (with honors) and History
Thesis: "[Ca II] Studies of Pre-Main Sequence Stars"
Advisor: William Herbst

Queen Mary College, University of London (Spring, 1987): astronomy and medieval history

Honors
Robbins Memorial Prize (History), Littell Prize (Astronomy), Wesleyan University
Phi Beta Kappa
Full Member, Sigma Xi

Research and Work Experience
Max-Planck-Institute for Extraterrestrial Physics: Research Scientist. 8/2005–4/2015. Visiting Scientist. 4/2015–present.

Instituto de Astrofísica de Canarias: Support Astronomer/Postdoc. 2/2000–7/2005.

Department of Astronomy, University of Wisconsin, Madison: Research Assistant.

The Aerospace Corporation: Associate of the Technical Staff, 1988–91, Member of the Technical Staff, 1991–92. Observing, data reduction and analysis for IR astronomical and atmospheric observations; Secret-level security clearance.

Teaching Experience
Teaching Assistant and guest lecturer, Department of Astronomy, U. Wisconsin, Madison:
Planned and conducted discussion sections for survey astronomy course; guest lecture in main class; graded; conducted and graded experimental computer-based lab sessions

Teaching Assistant, Department of Astronomy, Wesleyan University: Conducted lab sections; graded.

Collaborations with Graduate Students

Ignacio Trujillo (Ph.D. 2002, IAC): tested "Core-Sérsic" model for galaxy profiles (Graham et al. 2003), fitting complete surface-brightness profiles of 20 elliptical galaxies (Trujillo et al. 2004).

Leonel Gutiérrez (Ph.D. 2009, IAC): reduced imaging data and extracted and classified surface-brightness profiles of unbarred disk galaxies. These were analyzed together with the barred galaxy sample of Erwin et al. (2008), allowing the complete determination of how disk profiles vary with Hubble type (Gutiérrez et al 2011).

Maximilian Fabricius (Ph.D. 2012, MPE) and Stephanie Rusli (Ph.D. 2012, MPE): worked with my composite pipeline for reducing VLT-SINFONI IFU data to generate calibrated near-IR datacubes of nearby galaxy nuclei for use in measuring supermassive black hole masses. Rusli also fit surface-brightness profiles using Sérsic and core-Sérsic models to estimate core-deficit masses in SMBH host galaxies (Rusli et al. 2011; Rusli et al. 2013b; Erwin et al. 2016, in prep).

Sandesh Kulkarni (Ph.D. 2015, MPE): worked on reduction and analysis of imaging data from Hα Galaxy Groups Imaging Survey, producing, classifying, and analyzing radial Hα surface-brightness profiles; data will be compared with future VLT-KMOS observations of $z \sim 1$ galaxies to measure evolution of the dependence of star formation on environment.

Michael Opitsch (master's student and current Ph.D. student, MPE): performed 1D and 2D decompositions and morphological analyses of barred spiral galaxies, to separate out bulge and disk components for use in dynamical modeling of supermassive black hole masses (Saglia et al. 2016; Erwin et al. 2016, in prep).

Matias Blaña (current Ph.D. student, MPE): working on *N*-body modeling of morphology and kinematics of M31, including its classical bulge and bar, with matching of made-to-measure *N*-body models to images and kinematics of M31 (Blaña et al. 2016).

Other Student Collaborations

Rebeca Aladro (undergraduate student, IAC): worked with Leonel Gutiérrez in reducing imaging data and generating surface-brightness profiles of unbarred disk galaxies (Gutiérrez et al. 2011).

David Wilman (MPE) and I created a project (and galaxy-classification tool) for two Munich-area high-school students (Mareike Berger and Daniel Gunzl) participating in a week-long "research experience" program at MPE in 2011. They used this to check existing RC3 classifications of $\sim$ 1000 galaxies using SDSS images, flagging dubious cases for later re-classification by Wilman and myself; this work contributed to Wilman & Erwin (2012).

Research Grant Participation

Co-investigator on NASA HST Archival Research grants, 1996–1998

Co-investigator on renewals (2006 and 2008) of grants from Priority Programme 1177 ("Witnesses of Cosmic History: Formation and evolution of black holes, galaxies and their environment") of the Deutsche Forschungsgemeinschaft (German National Science Foundation).

Astronomical Software (Public Releases)

Imfit: Open-source C++ code for flexible galaxy image fitting, including easy addition of new components and multiple options for minimzation statistics and algorithms:
`http://www.mpe.mpg.de/~erwin/code/imfit/` and `http://github.com/perwin/imfit/`

Open-source Python code for searching multiple telescope archives:
`http://www.mpe.mpg.de/~erwin/code/`

Astronomical Observing

Successful proposals for observing time on numerous telescopes, include ESO-MPI 2.2-m, Isaac Newton 2.5-m, WIYN 3.5-m, TNG 3.5-m, NTT 3.5-m, William Herschel 4.2-m, Gemini North 8-m and ESO-VLT 8-m, and Hobby-Eberly 10-m telescopes with multiple imagers, spectrographs, and IFUs.

Infrared IFU 2D spectroscopy with AO at VLT (Paranal); optical imaging and multi-fiber spectroscopy at WIYN 3.5-m, KPNO; optical and near-IR imaging and long-slit spectroscopy at WHT 4.2-m, INT 2.5-m, and NOT 2.5-m (La Palma); near-IR spectroscopic observing at Lick Observatory (Shane 3m), Mt. Lemmon Observatory (UCSD/Wyoming 1.5m)

Instrument setup and support for visiting astronomers plus service/queue observing at Isaac Newton Group, La Palma (optical imaging and spectroscopy)

Astronomical Data Reduction and Analysis

Optical and near-IR imaging data reduction and analysis (including astrometric calibration)

IR spectroscopic data reduction and analysis, including integral-field-unit (IFU) data reduction and derivation of stellar kinematics

HST (ACS, WFPC2, NICMOS) data reduction and photometric calibration

Morphological analysis of galaxy images; 1D and 2D decomposition and modeling

Statistical analysis of astronomical measurements and samples

Other

Partially fluent in Spanish and German

Professional Activities

Member of Scientific Organizing Committee for "Galactic Rings" (proposed IAU General Assembly Symposium in Vienna, August 2018)

Member of Scientific Organizing Committee for "The Formation and Evolution of Exponential Disks in Galaxies" (Flagstaff, Arizona, 7–10 October 2014)

Ph.D. Examination Committee (external reviewer) for Tomás Ruiz Lara, *Characterization of the Stellar Populations in the Outer Parts of Spiral Galaxies*, Universidad de Granada, February 2016

Refereeing for *Nature*, *Monthly Notices of the Royal Astronomical Society*, *The Astrophysical Journal*, *The Astrophysical Journal Letters*, *The Astronomical Journal*, and *Astronomy & Astrophysics*

Proposal reviewing for NSF Astronomy & Astrophysics Grants program

Publications and Presentations

Invited Conference Talks in the Past Three Years

1. "Surface-brightness and star-formation profiles of galaxy disks: Observational perspectives, problems, questions, and possible answers," **Peter Erwin**, 2015. Invited review talk for Special Session 16 "The outskirts of galaxies: present status and future challenges" at European Week of Astronomy and Space Science, EWASS 2015, Tenerife, 23 July 2015.

2. "Disk Breaks and their Properties," **Peter Erwin**, 2014. Invited review talk for "The Formation and Evolution of Exponential Disks in Galaxies," Flagstaff, Arizona, 7 October 2014.

3. "Measuring Bars," **Peter Erwin**, 2013. Invited review talk for "The Role of Bars in Galaxy Evolution," Granada, Spain, 14 May 2013.

Refereed Papers

Submitted

1. "The Role of Host Galaxy for the Environmental Dependence of Active Nuclei in Local Galaxies," Richard I. Davies, E.K.S Hicks, **P. Erwin**, L. Burtscher, A. Contursi, R. Genzel, A. Janssen, M. Koss, M.-Y. Lin, D. Lutz, W. Maciejewski, F. Müller-Sánchez, G. Orban de Xivry, C. Ricci, R. Riffel, R.A. Riffle, D. Rosario, M. Schartmann, A. Schnorr-Müller, T. Shimizu, A. Sternberg, E. Sturm, T. Storchi-Bergmann, L. Tacconi, and S. Veilleux, *Monthly Notices of the Royal Astronomical Society*, submitted. (arXiv:1610.09890)

2. "The Frequency and Stellar-Mass Dependence of Boxy/Peanut-Shaped Bulges in Barred Galaxies," **Peter Erwin** and Victor P. Debattista, *Monthly Notices of the Royal Astronomical Society*, submitted.

3. "Andromeda Chained to the Box: Dynamical Models for M31: Bulge, Bar & Spurs," Matias Blaña Díaz, Chris Wegg, Ortwin Gerhard, **Peter Erwin**, Matthieu Portail, Michael Opitsch, Roberto Saglia, and Ralf Bender, *Monthly Notices of the Royal Astronomical Society*, submitted.

Published

1. "Peanut-shaped metallicity distributions in bulges of edge-on galaxies: the case of NGC 4710," Oscar A. Gonzalez, Victor P. Debattista, Melissa Ness, and **Peter Erwin**, *Monthly Notices of the Royal Astronomical Society*, in press.

2. "The supermassive black hole and double nucleus of the core elliptical NGC 5419," Ximena Mazzalay, Jens Thomas, Roberto P. Saglia, Gary A. Wegner, Ralf Bender, **Peter Erwin**, Maximilian H. Fabricius, and Stephanie Rusli, 2016, *Monthly Notices of the Royal Astronomical Society*, **462:** 2847.

3. "Caught in the Act: Direct Detection of Galactic Bars in the Buckling Phase," **Peter Erwin** and Victor P. Debattista, 2016, *The Astrophysical Journal Letters* **825:** L30.

4. "The SINFONI Black Hole Survey: The Black Hole Fundamental Plane revisited and the paths of (co-)evolution of supermassive black holes and bulges," R.P. Saglia, M. Opitsch, **P. Erwin**, J. Thomas, A. Beifiori, M. Fabricius, X. Mazzalay, N. Nowak, S. Rusli, and R. Bender, 2016, *The Astrophysical Journal*, **818:** 47.

5. "Properties and formation mechanism of the stellar counter-rotating components in NGC 4191," L. Coccato, M. Fabricius, L. Morelli, E.M. Corsini, A. Pizella, **P. Erwin**, E. Dalla Bontà, R. Saglia, R. Bender, and M. Williams, 2015, *Astronomy & Astrophysics*, **581:** A65.

6. "Composite Bulges: The Coexistence of Classical Bulges and Disky Pseudobulges in S0 and Spiral Galaxies," **Peter Erwin**, Roberto P. Saglia, Maximilian Fabricius, Jens Thomas, Nina Nowak, Stephanie Rusli, Ralf Bender, Juan Carlos Vega Beltrán, and John E. Beckman, 2015, *Monthly Notices of the Royal Astronomical Society*, **446:** 4039.

7. "Imfit: A Fast, Flexible New Program for Astronomical Image Fitting," **Peter Erwin**, 2015, *The Astrophysical Journal*, **799:** 226.

8. "The formation of stellar nuclear discs in bar-induced gas inflows," David R. Cole, Victor P. Debattista, **Peter Erwin**, Samuel Earp, and Rok Roškar, 2014, *Monthly Notices of the Royal Astronomical Society*, **445:** 3352.

9. "The HST/ACS Coma Cluster Survey. X. Nuclear star clusters in low-mass early-type galaxies: scaling relations," Mark den Brok, Reynier F. Peletier, Anil Seth, Marc Balcells, Lilian Dominguez, Alister W. Graham, David Carter, **Peter Erwin**, Henry C. Ferguson, Paul Goudfrooij, Rafael Guzmán, Carlos Hoyos, Shardha Jogee, John Lucey, Steven Phillipps, Thomas Puzia, Edwin Valentijn, Gijs Verdoes Kleijn, and Tim Weinzirl, 2014, *Monthly Notices of the Royal Astronomical Society*, **445:** 2385.

10. "Fueling Active Galactic Nuclei. II. Spatially Resolved Molecular Inflows and Outflows," R.I. Davies, E.K.S. Hicks, W. Maciejewski, E. Emsellem, **P. Erwin**, L. Burtscher, G. Dumas, M. Lin, M.A. Malkan, F. Müller-Sánchez, G. Orban de Xivry, D.J. Rosario, A. Schnorr-Müller, and A. Tran, 2014, *The Astrophysical Journal*, **792:** 101.

11. "The HST/ACS Coma Cluster Survey - VII. Structure and Assembly of Massive Galaxies in the Center of the Coma Cluster," Tim Weinzirl, Shardha Jogee, Eyal Neistein, Sadegh Khochfar, John Kormendy, Irina Marinova, Carlos Hoyos, Marc Balcells, Mark den Brok, Derek Hammer, Reynier F. Peletier, Gijs Verdoes Kleijn, David Carter, Paul Goudfrooij, John R. Lucey, Bahram Mobasher, Neil Trentham, **Peter Erwin**, and Thomas Puzia, 2014, *Monthly Notices of the Royal Astronomical Society*, **441:** 3083.

12. "Molecular gas in the centre of nearby galaxies from VLT/SINFONI integral field spectroscopy – II. Kinematics," X. Mazzalay, W. Maciejewski, **P. Erwin**, R.P. Saglia, R. Bender, M.H. Fabricius, N. Nowak, S.P. Rusli, and J. Thomas, 2014, *Monthly Notices of the Royal Astronomical Society*, **438:** 2036.

13. "The dynamical fingerprint of core scouring in massive elliptical galaxies," J. Thomas, R.P. Saglia, R. Bender, **P. Erwin**, and M. Fabricius, *The Astrophysical Journal*, 2014, **782:** 39.

14. "Depleted Galaxy Cores and Dynamical Black Hole Masses," S.P. Rusli, **P. Erwin**, R.P. Saglia, J. Thomas, M. Fabricius, R. Bender, and N. Nowak, 2013, *The Astronomical Journal*, **146:** 160.

15. "The Influence of Dark Matter Halos on Dynamical Estimates of Black Hole Mass," S.P. Rusli, J. Thomas, R.P. Saglia, M. Fabricius, **P. Erwin**, R. Bender, N. Nowak, C.H. Lee, A. Riffeser, and R. Sharp, 2013, *The Astronomical Journal* **146:** 45.

16. "The Hierarchical Origins of Observed Galaxy Morphology," David J. Wilman, Fabio Fontanot, Gabriella De Lucia, **Peter Erwin**, and Pierluigi Monaco, 2013, *Monthly Notices of the Royal Astronomical Society* **433:** 2986.

17. "Peanuts at an Angle: Detecting and Measuring the Three-Dimensional Structure of Bars in Moderately Inclined Galaxies," **Peter Erwin** and Victor P. Debattista, 2013, *Monthly Notices of the Royal Astronomical Society* **431**: 3060.

18. "Molecular gas in the centre of nearby galaxies from VLT/SINFONI integral field spectroscopy – I. Morphology and mass inventory," X. Mazzalay, R.P. Saglia, **Peter Erwin**, M.H. Fabricius, S.P. Rusli, Jens Thomas, R. Bender, M. Opitsch, N. Nowak, and Michael J. Williams, 2013, *Monthly Notices of the Royal Astronomical Society* **428**: 2389.

19. "Evolutionary Paths Between Different Red Galaxy Types and the Buildup of Massive E-S0's Through Major Mergers at $0.7 < z < 1.2$," Mercedes Prieto, M. Carmen Eliche-Moral, Marc Balcells, David Cristóbal-Hornillos, **Peter Erwin**, David Abreu, Lilian Domínguez-Palmero, Angela Hempel, Carlos López San Juan, Rafael Guzmán, Pablo Pérez-González, Guillermo Barro, Jesus Gallego, and Jaime Zamorano, 2013, *Monthly Notices of the Royal Astronomical Society* **428**: 999.

20. "Evolution of galactic disks: multiple patterns, radial migration and disk outskirts," I. Minchev, B. Famaey, A.C. Quillen, P. Di Matteo, F. Combes, M. Vlajić, **P. Erwin**, and J. Bland-Hawthorn, 2012, *Astronomy & Astrophysics* **548**: A126.

21. "The Relation Between Galaxy Morphology and Environment in the Local Universe: An RC3-SDSS Picture," David Wilman and **Peter Erwin**, 2012, *The Astrophysical Journal* **746**: 160.

22. "The HST/ACS Coma Cluster Survey: VIII. Barred Disk Galaxies in the Core of the Coma Cluster," Irina Marinova, Shardha Jogee, Tim Weinzirl, **Peter Erwin**, Neil Trentham, Henry C. Ferguson, Marc Balcells, David Carter, Mark den Brok, Alister W. Graham, Paul Goodfrooij, Rafael Guzmán, Derek Hammer, Carlos Hoyos, Bahram Mobasher, Mustapha Mouhcine, Reynier F. Peletier, Eric Peng, and Gijs Verdoes Kleijn, 2012, *The Astrophysical Journal* **746**: 136.

23. "A Strong Dichotomy in S0 Disk Profiles Between the Virgo Cluster and the Field," **Peter Erwin**, Leonel Gutiérrez, and John E. Beckman, 2012, *The Astrophysical Journal Letters* **744**: L11.

24. "Do Nuclear Star Clusters and Supermassive Black Holes Follow the Same Host-Galaxy Correlations?" **Peter Erwin** and Dimitri A. Gadotti, 2012, invited paper for *Advances in Astronomy* special issue, vol. 2012, Article ID 946368.

25. "The Outer Disks of Early-Type Galaxies. II. Surface-Brightness Profiles of Unbarred Galaxies and Trends with Hubble Type," Leonel Gutiérrez, **Peter Erwin**, Rebeca Aladro, and John E. Beckman, 2011, *The Astronomical Journal* **142**: 145.

26. "The HST/ACS Coma Cluster Survey: VII – Colour Gradients in Giant and Dwarf Early-Type Galaxies," M. den Brok, R.F. Peletier, E.A. Valentyn, M. Balcells, D. Carter, **P. Erwin**, H.C. Ferguson, P. Goudfrooij, A.W. Graham, D. Hammer, J.R. Lucey, N. Trentham, R. Guzmán, C. Hoyos, G. Verdoes Kleijn, S. Jogee, A.M. Karick, I. Marinova, M. Mouhcine, and T. Weinzirl, 2011, *Monthly Notices of the Royal Astronomical Society* **414**: 3052.

27. "The central black hole mass of the high-σ but low-bulge-luminosity lenticular galaxy NGC 1332," S. P. Rusli, J. Thomas, **P. Erwin**, R. P. Saglia, N. Nowak, and R. Bender, 2011, *Monthly Notices of the Royal Astronomical Society* **410**: 1223.

28. "The HST/ACS Coma Cluster Survey. II. Data Description and Source Catalogs," Derek Hammer and 46 co-authors, 2010, *The Astrophysical Journal Supplement* **191**: 143.

29. "Do black hole masses scale with classical bulge luminosities only? The case of the two composite pseudo-bulge galaxies NGC 3368 and NGC 3489," N. Nowak, J. Thomas, **P. Erwin**, R. P. Saglia, R. Bender, and R. I. Davies, 2010, *Monthly Notices of the Royal Astronomical Society* **403**: 646.

30. "The HST/ACS Coma Cluster Survey – V. Compact Stellar Systems in the Coma Cluster," J. Price, S. Phillipps, A. Huxor, N. Trentham, H. C. Ferguson, R. O. Marzke, A. Hornschemeier, P. Goudfrooij,

D. Hammer, R. B. Tully, K. Chiboucas, R. J. Smith, D. Carter, D. Merritt, M. Balcells, **P. Erwin**, and T. H. Puzia, 2009, *Monthly Notices of the Royal Astronomical Society* **397**: 1816.

31. "Robust Determination of the Major Merger Fraction at $z = 0.6$ in Groth Strip," Carlos López-Sanjuan, Marc Balcells, Cesar Enrique García-Dabó, Mercedes Prieto, David Cristóbal-Hornillos, M. Carmen Eliche-Moral, David Abreu, **Peter Erwin**, and Rafael Guzmán, 2009, *The Astrophysical Journal* **694**: 643.

32. "Bulges of Disk Galaxies at Intermediate Redshifts. I. Samples with and without Bulges in the Groth Strip," L. Domínguez-Palmero, M. Balcells, **P. Erwin**, M. Prieto, D. Cristóbal-Hornillos, M. C. Eliche-Moral, and R. Guzmán, 2008, *Astronomy & Astrophysics* **488**: 1167.

33. "The HST/ACS Coma Cluster Survey: I – Survey Objectives and Design," David Carter and 36 co-authors, 2008, *The Astrophysical Journal Supplement* **176**: 424.

34. "NGC 2655: From Inner Polar Ring to Outer Shells and Tails," Linda S. Sparke, Gustaaf van Moorsel, **Peter Erwin**, and Elizabeth Wehner, 2008, *The Astronomical Journal* **135**: 99.

35. "The Outer Disks of Early-Type Galaxies. I. Surface-Brightness Profiles of Barred Galaxies," **Peter Erwin**, Michael Pohlen, and John E. Beckman, 2008. *The Astronomical Journal* **135**: 20.

36. "Double-Barred Galaxies at Intermediate Redshifts: A Feasibility Study," Thorsten Lisker, Victor P. Debattista, Ignacio Ferreras, and **Peter Erwin**, 2006. *Monthly Notices* **370**: 477.

37. "GOYA Survey: U and B Number Counts in the Groth-Westphal Strip," M. Carmen Eliche-Moral, Marc Balcells, Mercedes Prieto, César E. García-Dabó, **Peter Erwin**, and David Cristóbal-Hornillos, 2006. *The Astrophysical Journal* **639**: 644.

38. "How Large Are the Bars in Barred Galaxies?" **Peter Erwin**, 2005. *Monthly Notices* **364**: 283.

39. "Anti-Truncation of Disks in Early-Type Barred Galaxies," **Peter Erwin**, John E. Beckman, and Michael Pohlen, 2005. *The Astrophysical Journal Letters* **626**: L81.

40. "The Nature of Luminous X-Ray Sources with Mid-Infrared Counterparts," A. Alonso-Herrero and 30 co-authors, 2004. *The Astrophysical Journal Supplement* **154**: 155.

41. "Evidence for a New Elliptical-Galaxy Paradigm: Sérsic and Core Galaxies," I. Trujillo, **Peter Erwin**, A. Asensio Ramos, and A.W. Graham, 2004. *The Astronomical Journal* **127**: 1917.

42. "Double-Barred Galaxies: I. A Catalog of Barred Galaxies with Secondary Bars and Inner Disks," **Peter Erwin**, 2004. *Astronomy & Astrophysics* **415**: 941.

43. "When Is a Bulge Not a Bulge? Inner Disks Masquerading as Bulges in NGC 2787 and NGC 3945," **Peter Erwin**, J.C. Vega Beltrán, Alister W. Graham, and J.E. Beckman, 2003. *The Astrophysical Journal* **597**: 929.

44. "An Imaging Survey of Early-Type Barred Galaxies," **Peter Erwin** and Linda S. Sparke, 2003. *The Astrophysical Journal Supplement* **146**: 299.

45. "A New Empirical Model for the Structural Analysis of Early-type Galaxies and a Critical Review of the Nuker Model," Alister W. Graham, **Peter Erwin**, I. Trujillo, and A. Asensio Ramos, 2003. *The Astronomical Journal* **125**: 2951.

46. "Double Bars, Inner Disks, and Nuclear Rings in Early-Type Disk Galaxies," **Peter Erwin** and Linda S. Sparke, 2002. *The Astronomical Journal* **124**: 65.

47. "A Correlation Between Galaxy Light Concentration and Supermassive Black Hole Mass," Alister W. Graham, **Peter Erwin**, N. Caon, and I. Trujillo, 2001. *The Astrophysical Journal Letters* **563**: L11.

48. "NGC 4340: Double Bar + Fossil Nuclear Ring," **Peter Erwin**, J.C. Vega Beltrán, and J. Beckman, 2001. *Astrophysics and Space Science Supplement* **277**: 457.

49. "Triple Bars and Complex Central Structures in Disk Galaxies," **Peter Erwin** and L.S. Sparke, 1999a. *The Astrophysical Journal Letters* **521**: L37–40.

50. "Vertical Instabilities and Off-Plane Orbits in Circumbinary Disks," **Peter Erwin** and L.S. Sparke, 1999b. *The Astrophysical Journal* **521**: 798–822.

51. "Near-Infrared and Ultraviolet Spectrophotometry of Symbiotic Novae," R.J. Rudy, S.R. Meier, G.S. Rossano, D.K. Lynch, R.C. Puetter, and **Peter Erwin**, 1999. *The Astrophysical Journal Supplement* **121**: 533–545.

52. "Near-Infrared Spectrophotometry of the Eruptive Star MWC 560," S.R. Meier, R.J. Rudy, D.K. Lynch, G.S. Rossano, **Peter Erwin**, and R.C. Puetter, 1996. *The Astronomical Journal* **111**: 476–479.

53. "Strong [Fe II] Emission from NGC 1275," R.J. Rudy, R.D. Cohen, G.S. Rossano, **Peter Erwin**, R.C. Puetter, M.A. Greenhouse, and C.E. Woodward, 1993. *The Astrophysical Journal* **414**: 527–534.

54. "Near-Infrared and Ultraviolet Spectrophotometry of the Young Planetary Nebular Hubble 12," R.J. Rudy, G.S. Rossano, **Peter Erwin**, R.C. Puetter, and W.A. Feibelman, 1993. *The Astronomical Journal* **105**: 1002–1009.

55. "The Near-Infrared [Fe II] Lines of MWC 922," R.J. Rudy, **Peter Erwin**, G.S. Rossano, and R.C. Puetter, 1992. *The Astrophysical Journal* **398**: 278–285.

56. "0.9–1.35 μm Spectra of Five Type Ia Supernovae Near Maximum Light," D.K. Lynch, **Peter Erwin**, R.J. Rudy, G.S. Rossano, and R.C. Puetter, 1992. *The Astronomical Journal* **104**: 1156–1160.

57. "Time Development of the Near-Infrared Spectrum of the Slow Nova V2214 Ophiuchi (Nova Ophiuchi 1988)," **Peter Erwin**, D.K. Lynch, R.J. Rudy, G.S. Rossano, and R.C. Puetter, 1992. *The Astronomical Journal* **103**: 1970–1975.

58. "0.8–1.6 Micron Spectroscopy of the Planetary Nebula NGC 7027," R.J. Rudy, **Peter Erwin**, G.S. Rossano, and R.C. Puetter, 1992. *The Astrophysical Journal* **384**: 536–544.

59. "The 1.0–1.3 μm Spectrum of LkHα 101," R.J. Rudy, **Peter Erwin**, G.S. Rossano, and R.C. Puetter, 1991. *The Astrophysical Journal* **383**: 344–350.

60. "Near-Infrared [Fe II] Emission of M82 Supernova Remnants: Implications for Tracing the Supernova Content of Galaxies," M.A. Greenhouse, C.E. Woodward, H.A. Thronson, Jr., R.J. Rudy, G.S. Rossano, **Peter Erwin**, and R.C. Puetter, 1991. *The Astrophysical Journal* **383**: 164–173.

61. "The 0.46–1.3 Micron Spectrum of the Planetary Nebular BD +30°3639," R.J. Rudy, R.D. Cohen, G.S. Rossano, **Peter Erwin**, R.C. Puetter, and D.K. Lynch, 1991. *The Astrophysical Journal* **380**: 151–160.

62. "Near-Infrared Spectroscopy of the Planetary Nebula NGC 6572," R.J. Rudy, G.S. Rossano, **Peter Erwin**, and R.C. Puetter, 1991. *The Astrophysical Journal* **368**: 468–473.

63. "An Early 1.0–1.35 μm Spectrum of Type Ia Supernova 1989B and the *J*-Band Absorption," D.K. Lynch, R.J. Rudy, G.S. Rossano, **Peter Erwin**, R.C. Puetter, and D. Branch, 1990. *The Astronomical Journal* **100**: 223–225.

64. "Nova Ophiuchi 1988: 0.9–1.35 μm Spectroscopy 6 Months After Discovery," D.K. Lynch, R.J. Rudy, G.S. Rossano, **Peter Erwin**, and R.C. Puetter, 1989. *The Astronomical Journal* **98**: 1682–1685.

Conference Proceedings:

1. "Antitruncations," John Beckman, Alejandro Borlaff, M. Carmen Eliche-Moral, Joan Font, and **Peter Erwin**, 2016. In *IAU Symposium 321: Formation and evolution of galaxy outskirts*, ed. A. Gil de Paz (Cambridge U. Press), in press.

2. "Using 3D Spectroscopy to Probe the Orbital Structure of Composite Bulges," **Peter Erwin**, Roberto Saglia, Jens Thomas, Maximilian Fabricius, Ralf Bender, Stephanie Rusli, Nina Nowak, John E. Beckman, and Juan Carlos Vega Beltrán, 2015. In *IAU Symposium 309: Galaxies in 3D across the Universe*, *Proceedings of the International Astronomical Union*, ed. B. Ziegler (Cambridge U. Press), 359.

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