

CURRICULUM VITAE

MICHELE D. THORNLEY

CURRENT POSITION:

Associate Professor
Department of Physics & Astronomy
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EDUCATION:

Ph.D. (Astronomy) May 1997, University of Maryland, College Park. Dissertation: “Dynamical Influences in Flocculent Galaxies: An Examination of Structure and Star Formation”.
Advisor: Dr. Lee G. Mundy.

M.S. (Astronomy) December 1994, University of Maryland, College Park.

B.S. (Physics, with Honors) May 1990, University of Puget Sound.

APPOINTMENTS:

- Visiting Astronomer, NAASC, National Radio Astronomy Observatory, July 2009—July 2010.
- Visiting Astronomer, Observatoire de Bordeaux, June 2005.
- Visiting Astronomer, Space Telescope Science Institute, 2003-04.
- Assistant Professor, Department of Physics (& Astronomy), Bucknell University, 2000-present.
- Jansky Postdoctoral Research Fellow, National Radio Astronomy Observatory, Charlottesville, VA, 1998-2000. Academic Host: Dr. Paul Vanden Bout.
- Alexander von Humboldt Research Fellow, Max-Planck-Institut fuer extraterrestrische Physik, Garching bei Muenchen, Germany, 1997-1998. Academic Host: Dr. Reinhard Genzel.
- Graduate Research Assistant, Laboratory for Millimeter-wave Astronomy, Department of Astronomy, University of Maryland, College Park, 1994-1996.
- Graduate Teaching Assistant, Department of Astronomy, University of Maryland, College Park, 1990-1993.

PROFESSIONAL SERVICE:

- Member, Renewing Small Telescopes for Astronomical Research (ReSTAR) Committee, 2007-2008.
- Member, National Radio Astronomy Observatory Users Committee, 2003-2006 (Chair: 2006).

PROFESSIONAL SOCIETIES:

- American Astronomical Society
- International Astronomical Union

RESEARCH INTERESTS:

My research focuses on the development and evolution of large-scale structure in external galaxies, and in particular how that structure is related to the star formation process on kiloparsec scales. My research utilizes observations of external galaxies over a wide range of wavelengths, from radio to optical wavelengths. In particular, I study the morphology and kinematics of molecular gas, atomic gas, and interstellar dust in nearby galaxies, in order to explore their relationship to star formation and the overall distribution of stellar mass in galaxies.

GRANTS

JPL/NASA (ID 1224769/1407), P.I. R. Kennicutt, plus 14 co-investigators: “SINGS: Spitzer Infrared Nearby Galaxies Survey” (2000-2007). From this grant, \$117,500 was allocated to support M. Thornley’s SINGS research at Bucknell.

TEACHING & OUTREACH:

As of the end of the 2008-2009 academic year, my teaching experience includes:

- Nine semesters of Introductory Astronomy (ASTR101/102: two-semester sequence, lecture and laboratory, 80-96 students enrolled per semester.) The laboratory component of this course includes a sequence of night-sky observing labs that incorporate 8-inch Meade LX200 telescopes and SBIG or Meade CCD cameras.
- Six semesters of Introductory Physics (PHYS 211/212: two-semester sequence, laboratory and problem sessions, 25-60 students per semester).
- Two semesters of Electromagnetic Theory I (PHYS 333: intensive problem solving lecture course for physics, engineering and mathematics majors, for 10-12 students each time the course is offered).
- Two semester of Astrophysics (ASTR301/PHYS301, ASTR401/PHYS401: an introduction to astrophysics for junior and senior physics, engineering, and mathematics majors, for 10-15 students each time the course is offered).
- One semester of Modern Optics (PHYS303: upper-division elective course for physics majors, for 5-10 students each time the course is offered).
- One semester of Light & Vision (PHYS142: an introductory lecture and laboratory course for non-science majors, for 14-18 students each time the course is offered.)

In addition, I have been actively involved with Bucknell Observatory public outreach activities, which bring approximately 500-1000 visitors to the Observatory each year. These activities involve biannual Observatory Open Houses, as well as numerous visits by Girl and Boy Scout troops, and local elementary and middle school classes.

SUPERVISED UNDERGRADUATE RESEARCH:

- Esther Chapman, REU student at Bucknell University (2006). Project: “The Relationship of Atomic Gas and Aromatic Emission in SINGS Spirals.”
- Christopher Wolfe*, REU student at Bucknell University (2003). Project: “Candidate protostellar disks in NGC 2071 IRS 1 and IRS 3.” Currently: graduate student at Lehigh University.

- Heather Beck*, REU student at Bucknell University (2003). Project: “Rotation of a H₂O maser disk in Cepheus A.” Currently: graduate student at the University of Virginia.
- Courtney Spohn-Larkins, Bucknell Research Student (2002). Project: “Radial Structure in Molecular and Stellar Disks of BIMA SONG Galaxies.” Currently: graduate student at University of Tulsa.
- Richard Magee, SINGS research student (2001). Project: “Nearby Galaxies in the Near Infrared.” Currently: graduate student at the University of Wisconsin, Madison.
- Richard Cool*, REU student at Bucknell University (2001). Project: “Search for H₂O masers in protostellar disks.” Currently: NSF graduate fellow at the University of Arizona.
- Dustin Bambic, REU student at NRAO Charlottesville (1999). Project: “NGC 7331: Examining Density Wave Contributions in Flocculent Galaxies.”

SELECTED PEER-REVIEWED PUBLICATIONS:

- Bigiel, F.; Leroy, A., Walter, F., Brinks, E.; de Blok, W. J. G., Madore, B., **Thornley, M. D.** 2008, *The Star Formation Law in Nearby Galaxies on Sub-Kpc Scales*, *Astronomical Journal*, 136, 2846.
- Leroy, A. K., Walter, F., Brinks, E., Bigiel, F., de Blok, W. J. G., Madore, B., **Thornley, M. D.** 2008, *The Star Formation Efficiency in Nearby Galaxies: Measuring Where Gas Forms Stars Effectively*, *Astronomical Journal*, 136, 2782.
- Walter, F., Brinks, E., de Blok, W. J. G., Bigiel, F., Kennicutt, R.C., **Thornley, M.D.**, Leroy, A. 2008, *THINGS: The HI Nearby Galaxy Survey*, *Astronomical Journal*, 136, 2563.
- Bendo, G. J.; Draine, B. T.; Engelbracht, C. W.; Helou, G.; **Thornley, M. D.**; Bot, C.; Buckalew, B. A.; Calzetti, D.; Dale, D. A.; Hollenbach, D. J.; Li, A.; Moustakas, J. 2008, *The relations among 8, 24 and 160 μ m dust emission within nearby spiral galaxies*, *Monthly Notices of the Royal Astronomical Society*, 389, 629.
- Kendall, S.; Kennicutt, R. C.; Clarke, C.; **Thornley, M. D.** 2008, *Tracing spiral density waves in M81*, *Monthly Notices of the Royal Astronomical Society*, 387, 1007.
- Kennicutt, R. C., Jr.; Calzetti, D.; Walter, F.; Helou, G.; Hollenbach, D. J.; Armus, L.; Bendo, G.; Dale, D. A.; Draine, B. T.; Engelbracht, C. W.; Gordon, K. D.; Prescott, M. K. M.; Regan, M. W.; **Thornley, M. D.**; Bot, C.; Brinks, E.; de Blok, E.; de Mello, D.; Meyer, M.; Moustakas, J.; Murphy, E. J.; Sheth, K.; Smith, J. D. T. 2007, *Star Formation in NGC 5194 (M51a). II. The Spatially Resolved Star Formation Law*, *Astrophysical Journal*, 671, 333.
- Bendo, G. J.; Calzetti, D.; Engelbracht, C. W.; Kennicutt, R. C.; Meyer, M. J.; **Thornley, M. D.**; Walter, F.; Dale, D. A.; Li, A.; Murphy, E. J. 2007, *Variations in 24- μ m morphologies*

* Co-advised with Prof. Jack Gallimore, Bucknell University.

among galaxies in the Spitzer Infrared Nearby Galaxies Survey: new insights into the Hubble sequence, Monthly Notices of the Royal Astronomical Society, 380, 1313.

- Calzetti, D., Kennicutt, R. C., Engelbracht, C. W., Leitherer, C., Draine, B. T., Kewley, L., Moustakas, J., Sosey, M., Dale, D. A., Gordon, K. D., Helou, G. X., Hollenbach, D. J., Armus, L., Bendo, G., Bot, C., Buckalew, B., Jarrett, T., Li, A., Meyer, M., Murphy, E. J., Prescott, M., Regan, M. W., Rieke, G. H., Roussel, H., Sheth, K., Smith, J. D. T., & **Thornley, M. D.**, Walter, F. 2007, *The Calibration of Mid-Infrared Star Formation Rate Indicators*, Astrophysical Journal, 666, 870.
- Cannon, J.M., Walter, F., Armus, L., Bendo, G. J., Calzetti, D., Draine, B. T., Engelbracht, C.W., Helou, G., Kennicutt, R. C., Jr., Leitherer, C., Roussel, H., Bot, C., Buckalew, B. A., Dale, D. A., de Blok, W. J. G., Gordon, K. D., Hollenbach, D. J., Jarrett, T. H., Meyer, M. J., Murphy, E. J., Sheth, K., & **Thornley, M. D.** 2006(b), *The Nature of Infrared Emission in the Local Group Dwarf Galaxy NGC 6822 as Revealed by Spitzer*, Astrophysical Journal, 652, 1170.
- Regan, M.W., **Thornley, M.D.**, Vogel, S.N., Sheth, K., Draine, B. T., Hollenbach, D. J., Meyer, M., Dale, D. A., Engelbracht, C. W., Kennicutt, R. C., Armus, L., Buckalew, B., Calzetti, D., Gordon, K. D., Helou, G., Leitherer, C., Malhotra, S., Murphy, E., Rieke, G. H., Rieke, M. J., & Smith, J. D. 2006, *The Radial Distribution of the Interstellar Medium in Disk Galaxies: Evidence for Secular Evolution*, Astrophysical Journal, 652, 1112.
- Murphy, E. J., Helou, G., Braun, R., Kenney, J. D. P., Armus, L., Calzetti, D., Draine, B. T., Kennicutt, Jr., R. C., Roussel, H., Walter, F., Bendo, G. J., Buckalew, B., Dale, D. A., Engelbracht, C. W., Smith, J. D. T. & **Thornley, M. D.** 2006(b), *The Effect of Star Formation on the Far-Infrared-Radio Correlation within Galaxies*, Astrophysical Journal Letters, 651, 111.
- Thornley, M.D.**, Braine, J., & Gardan, E. 2006, *Infrared Dust Emission in the Outer Disk of M51*, Astrophysical Journal Letters, 651, 101.
- Cannon, J. M., Smith, J.-D. T., Walter, F., Bendo, G. J., Calzetti, D., Dale, D. A., Draine, B. T., Engelbracht, C. W., Gordon, K. D., Helou, G., Kennicutt, Jr., R. C., Leitherer, C., Armus, L., Buckalew, B. A., Hollenbach, D. J., Jarrett, T. H., Li, A., Meyer, M. J., Murphy, E. J., Regan, M. W., Rieke, G. H., Rieke, M. J., Roussel, H., Sheth, K., & **Thornley, M. D.** 2006(a), *Warm Dust and Spatially Variable Polycyclic Aromatic Hydrocarbon Emission in the Dwarf Starburst Galaxy NGC 1705*, Astrophysical Journal, 647, 293.
- Murphy, E. J., Braun, R., Helou, G., Armus, L., Kenney, J. D. P., Gordon, K. D., Bendo, G. J., Dale, D. A., Walter, F., Oosterloo, T. A., Kennicutt, Jr., R. C., Calzetti, D., Cannon, J. M., Draine, B. T., Engelbracht, C. W., Hollenbach, D. J., Jarrett, T. H., Kewley, L. J., Leitherer, C., Li, A., Meyer, M. J., Regan, M. W., Rieke, G. H., Rieke, M. J., Roussel, H., Sheth, K., Smith, J. D. T., & **Thornley, M. D.** 2006(a), *An Initial Look at the Far-*

Infrared-Radio Correlation within Nearby Star-forming Galaxies Using the Spitzer Space Telescope, Astrophysical Journal, 638, 157.

Calzetti, D., Kennicutt, Jr., R. C., Bianchi, L., Thilker, D. A., Dale, D. A., Engelbracht, C. W., Leitherer, C., Meyer, M. J., Sosey, M. L., Mutchler, M., Regan, M. W., **Thornley, M. D.**, Armus, L., Bendo, G. J., Boissier, S., Boselli, A., Draine, B. T., Gordon, K. D., Helou, G., Hollenbach, D. J., Kewley, L., Madore, B. F., Martin, D. C., Murphy, E. J., Rieke, G. H., Rieke, M. J., Roussel, H., Sheth, K., Smith, J. D., Walter, F., White, B. A., Yi, S., Scoville, N. Z., Polletta, M., & Lindler, D. 2005, *Star Formation in NGC 5194 (M51a): The Panchromatic View from GALEX to Spitzer*, Astrophysical Journal, 633, 871.

Sheth, K., Vogel, S. N., Regan, M. W., **Thornley, M. D.**, & Teuben, P. J. 2005, *Secular Evolution via Bar-Driven Gas Inflow: Results from BIMA SONG*, Astrophysical Journal, 632, 217.

Cannon, J. M., Walter, F., Bendo, G. J., Calzetti, D., Dale, D. A., Draine, B. T., Engelbracht, C. W., Gordon, K. D., Helou, G., Kennicutt, R. C., Jr., Murphy, E. J., **Thornley, M. D.**, Armus, L., Hollenbach, D. J., Leitherer, C., Regan, M. W., Roussel, H., Sheth, K. 2005, *Spitzer Observations of the Supergiant Shell Region in IC 2574*, Astrophysical Journal Letters, 630, L37.

Regan, M. W., **Thornley, M. D.**, Bendo, G. J., Draine, B. T., Li, A., Dale, D. A., Engelbracht, C. W., Kennicutt, R. C., Jr., Armus, L., Calzetti, D., Gordon, K. D., Helou, G., Hollenbach, D. J., Jarrett, T. H., Kewley, L. J., Leitherer, C., Malhotra, S., Meyer, M., Misselt, K. A., Morrison, J. E., Murphy, E. J., Muzerolle, J., Rieke, G. H., Rieke, M. J., Roussel, H., Smith, J.-D. T., & Walter, F. 2004, *Spitzer Infrared Nearby Galaxies Survey (SINGS) Imaging of NGC 7331: A Panchromatic View of A Ringed Galaxy*, Astrophysical Journal Supplements, 154, 204.

Gordon, K. D., Pérez-González, P. G., Misselt, K. A., Murphy, E. J., Bendo, G. J., Walter, F., **Thornley, M. D.**, Kennicutt, R. C., Jr., Rieke, G. H., Engelbracht, C. W., Smith, J.-D. T., Alonso-Herrero, A., Appleton, P. N., Calzetti, D., Dale, D. A., Draine, B. T., Frayer, D. T., Helou, G., Hinz, J. L., Hines, D. C., Kelly, D. M., Morrison, J. E., Muzerolle, J., Regan, M. W., Stansberry, J. A., Stolovy, S. R., Storrie-Lombardi, L. J., Su, K. Y. L., & Young, E. T. 2004, *Spatially Resolved Ultraviolet, H α , Infrared, and Radio Star Formation in M81*, Astrophysical Journal Supplements, 154, 215.

Smith, J.-D. T., Dale, D. A., Armus, L., Draine, B. T., Hollenbach, D. J., Roussel, H., Helou, G., Kennicutt, R. C., Jr., Li, A., Bendo, G. J., Calzetti, D., Engelbracht, C. W., Gordon, K. D., Jarrett, T. H., Kewley, L., Leitherer, C., Malhotra, S., Meyer, M. J., Murphy, E. J., Regan, M. W., Rieke, G. H., Rieke, M. J., **Thornley, M. D.**, Walter, F., & Wolfire, M. G. 2004, *Mid-Infrared IRS Spectroscopy of NGC 7331: A First Look at the Spitzer Infrared Nearby Galaxies Survey (SINGS) Legacy*, Astrophysical Journal Supplements, 154, 199.

Willner, S. P., Ashby, M. L. N., Barmby, P., Fazio, G. G., Pahre, M., Smith, H. A., Kennicutt, R. C., Jr., Calzetti, D., Dale, D. A., Draine, B. T., Regan, M. W., Malhotra, S., **Thornley,**

- M. D.**, Appleton, P. N., Frayer, D., Helou, G., Stolovy, S., & Storrie-Lombardi, L. 2004, *Infrared Array Camera (IRAC) Observations of M81*, *Astrophysical Journal Supplements*, 154, 222.
- Kennicutt, Jr., R.C., Armus, L., Bendo, G., Calzetti, D., Dale, D.A., Draine, B.T., Engelbracht, C.W., Gordon, K.D., Grauer, A.D., Helou, G., Hollenbach, D.J., Jarrett, T.H., Kewley, L.J., Leitherer, C., Li, A., Malhotra, S., Regan, M.W., Rieke, G.H., Rieke, M.J., Roussel, H., Smith, J.-D.T., **Thornley, M.D.**, & Walter, F. 2003, *SINGS: The SIRTfF Nearby Galaxies Survey*, *Publications of the Astronomical Society of the Pacific*, 115, 928.
- Helfer, T.T., **Thornley, M.D.**, Regan, M.W., Wong, T., Sheth, K., Vogel, S.N., Blitz, L., & Bock, D.C.-J. 2003, *The BIMA Survey of Nearby Galaxies (BIMA SONG) II. The CO Data*, *Astrophysical Journal Supplements*, 145, 259.
- Gallimore, J.F., Cool, R.J., **Thornley, M.D.**, & McMullin, J. 2003, *Expansion of the R4 H₂O Maser Arc near Cepheus A HW2*, *Astrophysical Journal*, 586, 306.
- Sheth, K., Vogel, S.N., Regan, M.W., Teuben, P.J., Harris, A.I., & **Thornley, M.D.** 2002, *Molecular Gas and Star Formation in Bars of Nearby Spiral Galaxies*, *Astronomical Journal*, 124, 2581.
- Regan, M.W., **Thornley, M.D.**, Helfer, T.T., Sheth, K., Wong, T., Vogel, S.N., Blitz, L., Bock, D. C.-J. 2001, *The BIMA Survey of Nearby Galaxies. I. The Radial Distribution of CO Emission in Spiral Galaxies*, *Astrophysical Journal*, 561, 218.
- Thornley, M.D.**, Forster Schreiber, N.M., Lutz, D., Genzel, R., Spoon, H.W.W., Kunze, D., & Sternberg, A. 2000, *Massive Star Formation and Evolution in Starburst Galaxies: Mid-Infrared Spectroscopy with the ISO Short Wavelength Spectrometer*, *Astrophysical Journal*, 539, 641.
- Sturm, E., Lutz, D., Tran, D., Feuchtgruber, H., Genzel, R., Kunze, D., Moorwood, A.F.M., & **Thornley, M.D.** 2000, *ISO-SWS Spectra of Galaxies: Continuum and Features*, *Astronomy & Astrophysics*, 358, 481.
- Lutz, D., Kunze, D., Spoon, H.W.W., & **Thornley, M.D.** 1998, *Faint [O IV] Emission from Starburst Galaxies*, *Astronomy & Astrophysics Letters*, 333, L75.
- Thornley, M.D.**, & Mundy, L.G. 1997, *Dynamic and Stochastic Influences on Spiral Structure in the Flocculent Spiral NGC 4414*, *Astrophysical Journal*, 490, 682.
- Thornley, M.D.**, & Mundy, L.G. 1997, *Are Flocculent Spirals Devoid of Density Waves? Gas Morphology and Kinematics in NGC 5055*, *Astrophysical Journal*, 490, 682.
- Wilson, C.D., Walker, C.E., & **Thornley, M.D.** 1997, *The Density and Temperature of Molecular Clouds in M33*, *Astrophysical Journal*, 483, 210.

- Thornley, M.D.** 1996, *Uncovering Spiral Structure in Flocculent Galaxies*, Astrophysical Journal Letters, 469, L45.
- Thornley, M.D.**, & Wilson, C.D. 1995, *Molecular Gas in the Inner 3.2 Kpc of NGC 2403: Star Formation at Subcritical Gas Surface Densities*, Astrophysical Journal, 447, 616.
- Thornley, M.D.** & Wilson, C.D. 1994, *Constraining the Influence of Star Formation on the Lowest ^{12}CO Line Ratios in M33*, Astrophysical Journal, 421, 458.
- Tacconi, L. J., Tacconi-Garman, L. E., **Thornley, M.**, van Woerden, H. 1991, *CO observations of southern S0 galaxies*, Astronomy & Astrophysics, 252, 541.

INVITED PRESENTATIONS :

- 2008: *The local star formation environment in nearby galaxies, from SINGS and THINGS*, Lehigh University, Department of Physics colloquium, Nov. 2008.
- 2003: *Molecular Gas in Spiral Galaxies*, for the 4th Cologne-Bonn-Zermatt Symposium, The Dense Interstellar Medium in Galaxies, Eds. S.Pfalzner, C. Kramer, C. Staubmeier, A. Heithausen, Springer Proceedings in Physics, Vol. 91., 109 (Berlin, Heidelberg: Springer)
- 2003: *Molecular Gas and Star Formation in Nearby Galaxies*, for the annual April Meeting of the American Physical Society, Bulletin of the American Physical Society, Vol. 48, no. 2, p.82.
- 2000: *Molecular Gas in Spiral Galaxies: Implications for Galaxy Evolution from BIMA SONG*, in Galaxy Disks and Disk Galaxies, eds. J.G. Funes, S. J. and E. M. Corsini, ASP Conference Proceeding Vol. 230, 369 (San Francisco: Astronomical Society of the Pacific).
- 1999: *Molecular Gas and Star Formation in Nearby Spiral Galaxies*, in Science with the Atacama Large Millimeter Array, ed., A. Wootten, ASP Conference Proceeding Vol. 235, 291 (San Francisco: Astronomical Society of the Pacific).

OTHER SELECTED CONFERENCE PRESENTATIONS:

- Chapman, E., **Thornley, M.D.**, & The SINGS team, 2006, *The Relationship of Atomic Gas and Aromatic Emission in SINGS Spiral Galaxies*, American Astronomical Society meeting, 209, 15.03.
- Wong, T. & **Thornley, M.D.** 2003, *Molecular Gas and Star Formation in Nearby Galaxies*, in *Star Formation at High Angular Resolution*, Eds: M. Burton, R. Jayawardhana, T. Bourke, International Astronomical Union Symposium 221, 119

- Thornley, M. D.**, Spohn-Larkins, C. J. L., Regan, M. W., Sheth, K. 2003, *Radial Structure in Molecular and Stellar Disks of BIMA SONG Galaxies*, American Astronomical Society meeting, 201, 13.17.
- Sheth, K. Vogel, S.N., Teuben, P.J., Harris, A.I., Regan, M.W., **Thornley, M.D.**, & Helfer, T.T. 2002, *Comparing Molecular Gas and Star Formation Properties in the Central Regions of Barred and Unbarred*, in *Disks of Galaxies: Kinematics, Dynamics and Perturbations*, eds. E. Athanassoula, A. Bosma, and R. Mujica, ASP Conference Proceeding, Vol. 275, 263 (San Francisco: Astronomical Society of the Pacific).
- Bambic, D., **Thornley, M. D.** 1999, *NGC 7331: Examining Density Wave Contributions in Flocculent Galaxies*, American Astronomical Society Meeting, 195, 07.07.
- Thornley, M.D.**, Schreiber, N.M.F., Spoon, H.W.W., Genzel, R., Lutz, D., Kunze, D. 1999, *30 Doradus as a Nearby Infrared Guide to Starbursts*, in *New Views of the Magellanic Clouds*, eds. Y.-H. Chu, N. Suntzeff, J. Hesser, & D. Bohlender, IAU Symposium 190, 247.
- Thornley, M.D.**, Regan, M., Helfer, T., Sheth, K., Vogel, S., Harris, A., Wong, T., Blitz, L., & Bock, D. 1999, *The Role of Molecular Gas in Galaxy Evolution: Insights from BIMA SONG*, *Astrophysics & Space Science*, 269/270, 391.
- Thornley, M. D.**, Vogel, S. N., Helfer, T. T., Blitz, L., Bock, D. C.-J., Harris, A., Regan, M. W., Sheth, K., Wong, T. 1998, *A BIMA SONG Exploration of Interarm Molecular Gas in M51*, American Astronomical Society Meeting, 193, 28.01.