

Catherine J. Grier – Curriculum Vitae

Address:

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Education

Ph.D., Astronomy, *The Ohio State University*, Aug 2013
 Dissertation: *Active Galactic Nuclei: Masses and Dynamics*
 M.S., Astronomy, *The Ohio State University*, March 2010
 B.S., Astronomy & Physics (*GPA 3.82*), *University of Illinois at Urbana-Champaign*, May 2007
 Diploma, with Honors, *Naperville Central High School*, May 2003

Professional Appointments

Postdoctoral Research Associate	<i>Penn State University (PSU)</i>	(Sept 2014–present)
Planetarium Director & Postdoctoral Researcher	<i>The Ohio State University (OSU)</i>	(Aug 2013–Aug 2014)
Presidential Fellow	<i>The Ohio State University</i>	(Jan 2013–Aug 2013)
Planetarium Coordinator	<i>The Ohio State University</i>	(2012–2013)
Head Teaching Associate	<i>The Ohio State University</i>	(2009–2012)
Graduate Research Associate	<i>The Ohio State University</i>	(2007–2009)
Graduate Teaching Associate	<i>The Ohio State University</i>	(2007–2009)

Research Interests

Active galactic nuclei, reverberation mapping, the structure of the broad line region, supermassive black hole mass measurements, black hole–galaxy scaling relations, quasar emission-line and absorption-line variability

Honors and Awards

Presidential Fellowship, The Ohio State University Graduate School	2013
Allan Markowitz Graduate Award in Observational Astronomy	2012
NSF Graduate Research Fellowship Program, Honorable Mention	(2008, 2009)
Graduated Magna Cum Laude, Highest Distinction in Physics, UIUC	2007
Graduated with High Distinction in Astronomy, UIUC	2007
Stanley P. Wyatt Memorial Award, Dept. of Astronomy, UIUC	2007
Chancellor’s Scholar, UIUC	(2003-2007)
Dean’s List, UIUC	(2003-2007)
Edmund J. James Scholar, UIUC	(2003-2005)

Professional Memberships

American Astronomical Society	member since 2006
Astronomical Society of the Pacific	member 2013-2014
The Great Lakes Planetarium Association	member 2011-2013

Classroom Teaching Experience

Instructor, Astro 1, PSU — intro. astronomy course for non-science majors	(Spring 2016)
Guest/Substitute lecturer, PSU – Astro 485, High-Energy Astro for majors	(2015)
Guest/Substitute lecturer, PSU – several intro. astronomy classes	(2014-2015)
Head Teaching Associate, OSU – trained graduate students	(2009-2012)
Teaching Associate, Intro. Astronomy for B.S. majors, OSU	(2008-2009)
Teaching Associate, Intro. Astronomy, General Education, OSU	(2008)

Student Research Mentoring

I have been the primary research supervisor for PSU undergraduate Zach Hemler for his Honors Thesis work since Spring semester 2016 (expected graduation: May 2018).

**Selected Public
Outreach
Activities**

Penn State Astronomy Department Outreach Committee — (2017 – present)
Summer Cosmology Workshop for High School Teachers
at Penn State — guest speaker (2015, 2016)
Penn State Upward Bound Summer Experience in the Eberly College
of Science — supervisor/faculty sponsor (summer 2016)
Expanding Your Horizons STEM Career Day for Girls — group leader (January 2016)
Penn State Planetarium — Presenter (2014 – present)
Exploration U, State College High School — volunteer (March 2015)
AstroFest — Volunteer, Penn State (July 2015)
AstroNight — Volunteer, Penn State (October 2014)
Planetarium Director — OSU (2013-2014)
OSU Planetarium — Presenter and show coordinator (2008–2013)
OSU Star Parties — Volunteer, OSU (2008-2014)
Ohio State Fair — Physics Booth Volunteer (August 2010)
3rd Annual Midwest Women in Physics Conference — Session Chair (January 2010)
Astronomy Guest Lecturer, Blendon Career Day — Career Fair (May 2010)
Astronomy Guest Lecturer, St. Agatha Cub Scout pack 298 (January 2010)
Astronomy Day at COSI Columbus — Volunteer, OSU (Aug 2009)
Girls Reaching to Achieve in Sports and Physics, OSU — Volunteer (June 2008, 2010)
Girls Engaged in Math and Science Program, UIUC — Volunteer (May-June 2007)
Astronomy Guest Lecturer, Junior Stargazers, Champaign, IL (2007)
President & Vice President, UIUC Astronomical Society (2005-2007)

**Observing
Experience**

MDM 1.3m telescope; spectroscopy:
Reverberation Mapping Type 1 AGNs — 14 nights 2014 Feb, Mar.
Reverberation Mapping Type 1 AGNs — 10 nights 2012 Jan, Mar.
Reverberation Mapping Type 1 AGNs — 7 nights 2011 Dec.
Reverberation Mapping Type 1 AGNs — 13 nights 2010 Aug, Oct, Nov.
Spectroscopy of photometric variables — 4 nights, 2010 June.
Spectral Atlas of Reverberation Mapped AGNs — 5 nights, 2008 Jan.
MDM 1.3m telescope; imaging:
Imaging of nearby bright galaxies — 5 nights, 2010 March.
MDM 2.4m telescope; imaging:
Imaging of nearby bright galaxies — 5 nights, 2010 Oct.
Imaging of nearby bright galaxies — 5 nights, 2011 March.
Wyoming Infrared Observatory:
Summer Research Program observing — 5 nights, 2006 June.

Invited Talks

- **Grier, Catherine J.**, “The Monsters of the Universe: Supermassive Black Holes and their Masses”, Foxdale Retirement Community, Sept 26, 2017 (Public Talk)
- **Grier, Catherine J.**, “The Monsters of the Universe: Supermassive Black Holes and their Masses”, Fall 2016 Friedman Lecture in Astronomy, The Pennsylvania State University, Nov 10, 2016 (Public Talk)
- **Grier, Catherine J.**, “Broad Absorption Line Variability in Sloan Digital Sky Survey Quasars”, 2016 Sloan Digital Sky Survey Collaboration Meeting, Madison, WI, June 27, 2016 (Plenary Talk)
- **Grier, Catherine J.**, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping and BAL Variability Studies”, University of Michigan-Dearborn, October 2015 (Colloquium)
- **Grier, Catherine J.**, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping and BAL Variability Studies”, Virginia

Tech University, April 2015 (Colloquium)

- **Grier, Catherine J.**, “Investigating the Structure of the Broad Line Region in AGN with Reverberation Mapping”, Ohio University, November 2013 (Astrophysics Seminar)
- **Grier, Catherine J.**, “Measuring Black Hole Masses using Reverberation Mapping”, February 25, 2011, Kenyon College (Colloquium)

Professional Development and Workshops

- Annual Meeting of the American Astronomical Society — Various Locations, January 2013, 2014, 2015, & 2017
- Annual Meeting of the Great Lakes Planetarium Association — Peoria, IL, October 2013
- Annual Meeting of the Astronomical Society of the Pacific: Ensuring STEM Literacy — San Jose, CA, August 2013
- Astronomy Ambassadors Outreach Workshop — Long Beach, CA, January 2013
- The Spitz Summer Institute — Chadds Ford, PA, August 2012
- DARK Cosmology Center AGN Workshop — Copenhagen, Denmark, July 2012
- Preparing Future Faculty Program, The OSU Graduate School — Columbus, OH, Sept 2010-March 2011
- Improving the College Introductory Astronomy Survey Course for Non-Science Majors through Active Engagement: A Tier I (Introductory) Workshop from the Center for Astronomy Education — Oberlin, OH, September 2010

Grants Received

- Science PI, National Science Foundation Award AST-1517113, “The First Multi-Object Reverberation Mapping Survey: Transforming Our Knowledge of Distant Black Hole Demographics, Administrative PI: D. P. Schneider, \$321,786.
- Co-Investigator, Space Telescope Science Institute Grant HST-GO-15260, “Ultraviolet Echoes of Quasar Accretion Disks”, PI: J. R. Trump
- Co-Investigator, Space Telescope Science Institute Grant HST-GO-13330, “Mapping the AGN Broad-Line Region by Reverberation”, PI: B.M. Peterson, \$335,846.
- Co-Investigator, Space Telescope Science Institute Grant HST-GO-13765, “A Cepheid-based Distance to the Benchmark AGN NGC4151”, PI: B.M. Peterson, \$55,434.
- Co-Investigator, Space Telescope Science Institute Grant HST-GO-13816, “High-Resolution Imaging of Active Galaxies with Direct Black Hole Mass Measurements”, PI: M. C. Bentz, ~\$71,459.

First-Author Publications

10. **Grier, C. J.** and 41 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: H-alpha and H-beta Reverberation Measurements from First-Year Spectroscopy and Photometry”, 2017, ApJ, 851, 1
9. **Grier, C. J.**, Pancoast, A., Barth, A. J., Fausnaugh, M. M., Brewer, B. J., Treu, T., & Peterson, B. M., “The Structure of the Broad-Line Region in Active Galactic Nuclei. II. Dynamical Modeling of Data from the AGN10 Reverberation Mapping Campaign”, 2017, ApJ, 849, 146
8. **Grier, C. J.** and 12 coauthors, “CIV Broad Absorption Line Acceleration in Sloan Digital Sky Survey Quasars”, 2016, ApJ, 824, 130
7. **Grier, C. J.** and 24 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: Rapid CIV Broad Absorption Line Variability”, 2015, ApJ, 806, 111

6. **Grier, C. J.**, and 9 coauthors, “Stellar Velocity Dispersion Measurements in High-Luminosity Quasar Hosts and Implications for the AGN Black Hole Mass Scale”, 2013, ApJ, 773, 90
5. **Grier, C. J.**, and 40 coauthors, “The Structure of the Broad Line Region in AGN: I. Reconstructed Velocity-Delay Maps”, 2013, ApJ, 764, 47
4. **Grier, C. J.**, and 42 coauthors, “Reverberation Mapping Results for Five Seyfert 1 Galaxies”, 2012, ApJ, 755, 60
3. **Grier, C. J.**, and 38 coauthors, “A Reverberation Lag for the High-ionization Component of the Broad-line Region in the NLS1 Mrk 335”, 2012, ApJL, 744, 4
2. **Grier, C. J.**, S. Mathur, H. Ghosh, & Ferrarese, L., “Discovery of Nuclear X-ray Sources in SINGS Galaxies”, 2011, ApJ, 731, 60
1. **Grier, C. J.**, and 16 coauthors, “The Mass of the Black Hole in the Quasar PG 2130+099”, 2008, ApJ, 688, 837

**Contributing-
Author
Publications (with
direct/substantial
contributions)**

These publications are those on which I have contributed directly in some way to the data analysis and/or science results of the papers as a contributing author.

14. Fausnaugh, M. M., Starkey, D. A., Horne, Keith, Kochanek, C. S., Peterson, B. M., Bentz, M. C., Denney, K. D, **Grier, C. J.**, and 64 coauthors, “Continuum Reverberation Mapping of the Accretion Disks in Two Seyfert 1 Galaxies”, 2017, ApJ, submitted
13. Li, Jennifer, Shen, Yue, Horne, Keith, Brandt, W. N., Greene, Jenny E., **Grier, C. J.**, and 10 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: Composite Lags at $z \leq 1$ ”, 2017, ApJ, 846, 79
12. McGraw, S. M., Brandt, W. N., **Grier, C. J.**, Filiz Ak, N., Hall, P. B., Schneider, D. P., Anderson, S. F., Green, P. J., Hutchinson, T. A., McCleod, C. L., and Vivek M., “Broad Absorption Line Disappearance and Emergence Using Multiple-Epoch Spectroscopy From the Sloan Digital Sky Survey”, 2017, MNRAS, 469, 3163
11. Fausnaugh, M. M., **Grier, C. J.**, and 69 coauthors, “Reverberation Mapping of Optical Emission Lines in Five Active Galaxies”, 2017, ApJ, 840, 97
10. Yi, Weimin, Green, Richard, Bai, Jin-Ming, Wang, Tinggui, **Grier, C. J.**, and 24 coauthors, “The Physical Constraints on a New LoBAL QSO at $z = 4.82$ ”, 2017, ApJ, 838, 135
9. Pei, L. and 155 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. V. Optical Spectroscopic Campaign and Emission-line Analysis for NGC 5548”, 2017, ApJ, 837, 131
8. Denney, K. D. , Horne, Keith, Brandt, W. N., **Grier, C. J.**, and 4 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: Biases in $z > 1.46$ Redshifts due to Quasar Diversity”, 2016, ApJ, 833, 33
7. Shen, Yue, Brandt, W. N., Denney, K. D., Greene, Jenny E., **Grier, C. J.**, and 7 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: Velocity Shifts of Quasar Emission Lines”, 2016, ApJ, 831, 7
6. Shen, Yue, Horne, Keith, **Grier, C. J.** and 26 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: First Broad-line $H\beta$ and Mg II Lags at $z \geq 0.3$ from Six-Month Spectroscopy”, 2016, ApJ, 818, 30
5. Peterson, B.M., **Grier, C. J.**, & 44 coauthors, “Reverberation Mapping of the Seyfert 1 Galaxy NGC 7469”, 2014, ApJ, 795, 149

4. Peterson, B.M., Denney, K.D., De Rosa, G., **Grier, C. J.**, & 7 coauthors, “The Size of the Narrow-Line Emitting Region in the Seyfert 1 Galaxy NGC5548 from Emission-Line Variability”, 2013, ApJ, 779, 109
3. Bentz, M. C., Denney, K. D., **Grier, C. J.**, & 14 coauthors, “The Low-Luminosity End of the Radius-Luminosity Relationship for Active Galactic Nuclei”, 2013, ApJ, 767, 149
2. Dietrich, M., Peterson, B.M., **Grier, C. J.**, and 7 coauthors, “Optical Monitoring of the Broad-Line Radio Galaxy 3C 390.3”, 2013, ApJ, 757, 53
1. Wilhite, Brian C., Brunner, R. J., **Grier, C. J.**, Schneider, D. P., & vanden Berk, D. E., “On the variability of quasars: a link between the Eddington ratio and optical variability?”, 2008, MNRAS, 383, 1232

**Contributing-
Author
Publications
(indirect
contributions)**

These publications are those on which I was included as a contributing member of a collaboration, in a data-providing role, or other indirect role and did not participate significantly in the data analysis for the paper.

16. Mathur, S., and 149 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. VII. Understanding the Ultraviolet Anomaly in NGC 5548 with X-Ray Spectroscopy”, 2017, ApJ, 846, 55
15. The SDSS Collaboration (327 coauthors, including **Grier, C. J.**), “The Fourteenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the extended Baryon Oscillation Sky Survey and from the second phase of the Apache Point Observatory Galactic Evolution Experiment”, 2017, ApJS, accepted, arXiv:1707.09322
14. Blanton, M. and 362 coauthors, including **Grier, C. J.** “Sloan Digital Sky Survey IV: Mapping the Milky Way, Nearby Galaxies, and the Distant Universe”, 2017, AJ, 154, 28
13. McLeod, Chelsea and 36 coauthors, including **Grier, C. J.**, 2017, “The Time-Domain Spectroscopic Survey: Target Selection for Repeat Spectroscopy”, 2017, AJ, 155, 1
12. Jiang, Y.-F., and 23 coauthors, including **Grier, C. J.**, “Detection of Time Lags between Quasar Continuum Emission Bands Based on Pan-STARRS Light Curves”, 2017, ApJ, 836, 186
11. Starkey, D. and 91 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. VI. Reverberating Disk Models for NGC 5548”, 2017, ApJ, 835, 65
10. The SDSS Collaboration (338 coauthors, including **Grier, C. J.**, “The Thirteenth Data Release of the Sloan Digital Sky Survey: First Spectroscopic Data from the SDSS-IV Survey Mapping Nearby Galaxies at Apache Point Observatory”, 2016, ApJS, submitted, arXiv:1608.02013
9. Goad, M. and 100 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. IV. Anomalous Behavior of the Broad Ultraviolet Emission Lines in NGC 5548”, 2016, ApJ, 824, 11
8. Fausnaugh, M. M. and 96 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. III. Optical Continuum Emission and Broadband Time Delays in NGC 5548”, 2016, ApJ, 821, 56
7. Trump, Jonathan R. and 12 coauthors, including **Grier, C. J.**, “The Biases of Optical Line-Ratio Selection for Active Galactic Nuclei and the Intrinsic Relationship between Black Hole Accretion and Galaxy Star Formation”, 2015, ApJ, 811, 26

6. Edelson, R., and 49 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project. II. Swift and HST Reverberation Mapping of the Accretion Disk of NGC 5548”, 2015, ApJ, 806, 129
5. De Rosa, G. and 49 coauthors, including **Grier, C. J.**, “Space Telescope and Optical Reverberation Mapping Project.I. Ultraviolet Observations of the Seyfert 1 Galaxy NGC 5548 with the Cosmic Origins Spectrograph on Hubble Space Telescope”, 2015, ApJ, 806, 128
4. Denney, K.D., De Rosa, G., Croxall, K., Gupta, A., Bentz, M.C., Fausnaugh, M. M., **Grier, C. J.**, & 5 coauthors, “AGN Type-casting: Mrk 590 No Longer Fits the Role”, 2014, ApJ, 796, 134
3. Somers, G., Mathur, S., Martini, P., Watson, L. C., **Grier, C. J.**, & Ferrarese, L., “Discovery of a Large Population of Ultraluminous X-ray Sources in the Bulgeless Galaxies NGC 337 and ESO 501-23”, 2013, ApJ, 777, 7
2. Assef, R. J., Frank, S., **Grier, C. J.**, Kochanek, C. S., Denney, K. D., & Peterson, B. M., “The Importance of Broad Emission-Line Widths in Single Epoch Black Hole Mass Estimates”, 2012, ApJ, 753L, 2
1. Assef, R. J., and 32 coauthors, including **Grier, C. J.**, “Black Hole Mass Estimates Based on CIV are Consistent with Those Based on the Balmer Lines”, 2011, ApJ, 742, 93

Conference Proceedings

2. **Grier, C. J.**, Peterson, B. M., Denney, K. D., Bentz, M. C., & Pogge, R. W., “New Results in Reverberation Mapping”, Narrow-Line Seyfert 1 Galaxies and their place in the Universe. April 4-6, 2011. Milano, Italy. Proceedings of Science (PoS, Trieste, Italy), NLS1
1. Ganguly, R., Misawa, T., Lynch, R., Charlton, J.C., Eracleous, M., Hawthorn, M.J., & **Grier, C. J.**, “Quasar Intrinsic Absorption in the HST Archive”, 2007, ASPC, 393, 297

Contributed Presentations at Meetings and Workshops

- **Grier, Catherine J.**, & 5 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: $H\alpha$ and $H\beta$ Reverberation Measurements from First-Year Spectroscopy and Photometry”, Meeting of the American Astronomical Society #231, planned for January 2018 (poster)
- **Grier, Catherine J.**, & 5 coauthors, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping Studies”, Meeting of the American Astronomical Society #229, January 2017 (contributed talk)
- **Grier, Catherine J.**, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping Studies”, 2016 Sloan Digital Sky Survey Collaboration Meeting, Madison, WI, June 27, 2016, (poster)
- **Grier, Catherine J.**, “Broad Absorption Line Variability in Sloan Digital Sky Survey Quasars”, The Great Lakes Quasar Symposium, London, Ontario, May 1-4 2016, (contributed talk)
- **Grier, Catherine J.**, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping Studies”, The Great Lakes Quasar Symposium, London, Ontario, May 1-4 2016, (poster)
- **Grier, Catherine J.**, “The Sloan Digital Sky Survey Reverberation Mapping Project: Quasar Reverberation Mapping and BAL Variability Studies”, Joint Space-Science Institute Workshop: “The Physics of Supermassive Black Hole Formation and Feedback”, October 2015 (poster)

- **Grier, Catherine J.**, & 5 coauthors, “Rapid C IV Variability in an SDSS-RM Quasar”, Meeting of the American Astronomical Society #225, January 2015 (contributed talk)
- **Grier, Catherine J.**, & 6 coauthors, “The Broad Line Region in AGNs: Structure, Physics, and the f Factor”, Meeting of the American Astronomical Society #223, January 2014 (contributed talk)
- Bentz, M. C., Denney, K.D., **Grier, Catherine J.**, Barth, A. J., Peterson, B. M., & Vestergaard, M., “The Low Luminosity End of the Radius-Luminosity Relationship for Active Galactic Nuclei”, Meeting of the American Astronomical Society #223, January 2014 (poster)
- **Grier, Catherine J.**, “The Broad Line Region in AGNs: Velocity-Delay Maps from Reverberation Mapping”, Meeting of the American Astronomical Society #221, January 2013 (dissertation talk)
- Dietrich, M., Peterson, B.M., & **Grier, Catherine J.**, “3C390.3: Variability and Black Hole Mass”, Meeting of the American Astronomical Society #217, January 2011 (poster)
- **Grier, Catherine J.**, and 4 coauthors, “New results in reverberation mapping”, Narrow-Line Seyfert 1 Galaxies and their place in the Universe, Milano, Italy, April 4-5, 2011 (poster)
- **Grier, Catherine J.**, and 10 coauthors, “The High-Luminosity end of the $M_{\text{BH}}-\sigma_*$ Relation”, IAU Symposium 267, Rio de Janeiro, Brazil, 10 August, 2009 (poster)
- Dietrich, M., Peterson, B.M., & **Grier, Catherine J.**, “Reverberation Mapping of 3C390.3”, Meeting of the American Astronomical Society, Washington D. C., January 2010 (poster)
- Ganguly, R., Misawa, T., Lynch, R., Charlton, J.C., Eracleous, M., Hawthorn, M.J., & **Grier, Catherine J.**, “Quasar Intrinsic Absorption in the HST Archive”, 2007, ASPC, 373, 297 (poster)
- Wilhite, B.C., Brunner, R.J., Lundgren, B. F., & **Grier, Catherine J.**, “Studies of Quasar Variability with the Sloan Digital Sky Survey”, Meeting of the American Astronomical Society, Seattle, WA, January 2007 (poster)
- **Grier, Catherine J.**, and 5 coauthors, “Intrinsic Absorption in the HST Archive I: Search for Time Variable Systems”, Meeting of the American Astronomical Society, Seattle, WA, January 2007 (poster)
- **Grier, Catherine J.**, and 2 coauthors, “Statistical Comparisons of H₂O Megamaser Galaxies and Type 2 Active Galaxies”, Meeting of the American Astronomical Society, Washington D. C., January 2006 (poster)