Rachel K.D. MacDonald

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Education

Ph.D., Astronomy, Yale University — expected 2015
Dissertation: "Quiescence in Black Hole X-ray Binaries"
Advisor: Charles Bailyn

M.S. & M.Phil, Astronomy, Yale University — 2011

B.S., Astronomy and Physics, University of Washington — 2008

Certificate in Editing, University of Washington — 2002

M.L.I.S., University of Washington — 1997

B.A., English and History, Willamette University — 1995

Research and Teaching Experience in Astronomy and Libraries

Graduate Student Researcher, Astronomy Dept., Yale Univ. — 2008 – present

- Reduced astronomical data in multiple wavelength regimes (optical, near-infrared, X-ray, radio).
- Analyzed photometry, spectra, and time series.
- Wrote programming scripts as needed for data reduction and analysis using IDL, IRAF, shell scripts, R, and Python.
- Wrote successful proposals for competitively-awarded telescope time.
- Published peer-reviewed journal articles.

Teaching Fellow, Astronomy Dept., Yale Univ. — 2008 – 2014

- Courses: *Archaeoastronomy* ; *Introduction to Astronomical Observing* ; *Gravity, Astrophysics, and Cosmology* ; *Planets and Stars* ; *Stars and Their Evolution* ; *Frontiers and Controversies in Astrophysics* ; *Galaxies and the Universe* ; *Galaxies and Cosmology*
- Prepared and gave short lectures: researched topics, found or created visual aids (graphics, powerpoint slides, demonstrations), delivered lectures, answered student questions.
- Helped students figure out how to do mathematical and qualitative homework problems.
- Demonstrated use of software (planetarium simulation; image manipulation; telescope and camera control programs).
- Held physical and virtual (email) office hours to answer students' questions.
- Graded homework and exams; explained grading decisions and policies as necessary.

Teaching Assistant, Astronomy Dept., Univ. of Washington — 2008

- Courses: *Astronomy* ; *The Planets*
- Taught 4 required lab/discussion sections of 25 students each.
- Gave short lectures introducing topics in lab exercises.
- Helped students work through lab and worksheet exercises.
- Answered students' questions in class and during office hours.
- Graded exams and weekly homework exercises; explained grading decisions and policies when necessary.
- Assisted in assignment of final course grades.

Undergraduate Researcher, Univ. of Colorado, Boulder (REU) 2007

- Examined astronomical images and magnetograms using IRAF and IDL.
- Mined online historical sunspot data, pulling out sunspot categorizations over a period of many years.
- Investigated latitudinal distribution of delta-type sunspots as compared to other types.
- Created and presented poster summarizing project.

Undergraduate Researcher, National Solar Observatory (REU) 2006

- Used IDL and basic Linux shell scripting to examine astronomical images.
- Performed basic statistical analysis.
- Wrote final report summarizing project, and contributed to refereed publication which followed.

Reference Librarian, Green River Community College 1997 – 2004

- Taught students basic library use, how to find books and how to do online research [pre-Google era].
- Taught class sessions covering general research strategies, keyword and advanced searching, and citation styles.
- Wrote how-to guides for searching the Web [pre-Google era], for evaluating the credibility of a web site, and for using multiple online databases [e.g., ProQuest Direct, EBSCOhost, LaserCat].
- Assisted students with general computer use, including MS Office and basic troubleshooting.
- Designed and maintained library web site (HTML4); created and organized content, including library information and links to useful research resources on the web.
- Supervised undergraduate student workers (8-12 students at any one time) in the computer lab area; included hiring, evaluating and disciplining the students, training them in computer troubleshooting and basic library use, and organizing the schedule each term.

Select Publications and Presentations

Refereed Publications

MacDonald, R.K.D., Bailyn, C.B., Buxton, M., Cantrell, A., Chatterjee, R., Kennedy-Shaffer, R., Orosz, J., Markwardt, C., & Swank, J. "The Black Hole Binary V4641 Sagitarii: Activity in Quiescence and Improved Mass Determinations", 2014, *The Astrophysical Journal*, 784, 2

Penn, M.J., & **MacDonald, R.K.D.** "Solar Cycle Changes in Sunspot Umbral Intensity", 2007, *The Astrophysical Journal*, 662, L123

Fidel, R., **Davies, R.K.**, et al. "A Visit to the Information Mall: Web Searching Behavior of High School Students", 1999, *Journal of the American Society for Information Science*, 50, 24

Talks and Posters

"Accretion and Outflows in X-ray Binaries" [Talk] 2015
225th American Astronomical Society (AAS) Meeting

"Optical States in the Black Hole X-ray Binary V4641 Sgr" [Talk] 2011
New England Regional Accreting Binaries Annual Meeting (Yale Univ.)

"V4641 Sgr in X-ray Quiescence" [Poster] 2011
Black Hole Astrophysics: Tales of Power & Destruction Conference
Winner: Best Poster

	"Optical Activity in V4641 Sgr" [Poster] 2011 *217th AAS Meeting* "Testing a Possible Scenario for Delta-Spot Formation" [Poster] 2007 *American Geophysical Union Meeting* "Changes in Sunspot Umbral Intensity Over Time" [Poster] 2007 *209th AAS Meeting*
Competitively-Awarded Observing Proposals	**SMARTS Observations of X-ray Binaries** *Instrument*: ANDICAM (optical and near-infrared imager, 1.3m telescope, SMARTS, CTIO *Semesters*: 2011B, 2012A, 2012B, 2013B, 2014A **Simultaneous Spectroscopy and Photometry of the Black Hole X-ray Binary GRO J0422+32** *Instruments*: WHIRC (near-infrared imager), WIYN telescope; NIRSPEC (near-infrared spectrograph), Keck II telescope *Semesters*: 2010B, 2011B
Continuing Education	**AAS Astronomy Ambassadors Workshop** 2015 Introduction to techniques for doing astronomy outreach; demonstrations of activities teaching particular concepts or aimed at particular audiences; discussions about how to teach, how to answer questions, and other general outreach topics. **9th Chandra/CIAO Workshop** 2013 Introduction to analysis of Chandra X-ray data, including downloading, calibrating, plotting, and basic analysis and model-fitting using CIAO. **Summer School in Statistics for Astronomers** 2012 Explanations of statistical analyses using real astronomical data in examples; discussions of uncertainties in astronomical data and their effects on analysis and methods; hands-on sessions working through statistical and programming examples in R. **SciCoder Workshop** 2011 Introduction to object-oriented programming, good programming practices, Python, version control, and basic database design.
Education, Outreach, and Service	**Volunteer**, Leitner Family Observatory and Planetarium 2009 – present Run planetarium; give short talks about what is currently visible in the sky; set-up telescopes; help people use telescopes; answer questions at many different levels about astronomy. **Reading Tutor**, New Haven Reads 2014 Tutored elementary-school children in basic reading skills. **Committee Member**, Time Allocation Comm., Astronomy Dept., Yale Univ. 2012 Evaluated and ranked observing proposals from department members; decided which proposals to approve and how much time from Yale's allotments should be allocated to each one. **Co-organizer**, "Black Hole Accretion Disk (BHAD) News" journal club, Astronomy Dept., Yale Univ. 2011 – 2013 Scheduled meetings; emailed participants with regular updates; chose papers to discuss; prepared short presentations on one paper per week.
Skills and Languages	**Astronomical Instruments Used** o ANDICAM: dual imager (optical and near-infrared), SMARTS 1.3m telescope, Cerro Tololo Inter-American Observatory

- RCSPEC: optical spectrograph, SMARTS 1.5m telescope, Cerro Tololo Inter-American Observatory
- WHIRC: near-infrared imager, WIYN Observatory
- NIRSPEC: near-infrared spectrograph, Keck II telescope, W.M. Keck Observatory
- ACIS: X-ray imaging spectrometer, Chandra X-ray Observatory

Programming, Analysis, & Data Reduction

IDL, IRAF, LaTeX, R, Python, CIAO (Chandra X-ray data), CASA (EVLA radio data), awk & shell scripting

Languages

- English: native language
- French: intermediate (speaking, reading, writing)
- Spanish: intermediate (reading), basic (speaking, writing)