

LAURA BÎRZAN

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- EDUCATION
- **Ohio University**, Athens, OH.
Ph.D. in Physics and Astronomy, August 2007.
Thesis: *Radio and X-ray Properties of Cavities in the Hot Atmospheres of Ellipticals, Groups, and Clusters.*
 - **University of Bucharest**, Romania.
M.S. in Physics, 1999.
B.S. in Physics, 1998.
- RESEARCH INTERESTS
- X-ray and radio emission from clusters of galaxies. Effects of feedback from active galactic nuclei on the intracluster medium. Cluster magnetic fields.
- THESIS RESEARCH
- **Advisor:** Brian McNamara (Ohio University/ University of Waterloo)
 - **Topic:** Study of radio and X-ray properties of cavities in the intracluster medium created by radio sources in the cores of clusters of galaxies. Research included:
 - Reduction and analysis of *Chandra* X-ray data for ~ 20 clusters.
 - Writing 2 successful VLA proposals to supplement and extend data in the VLA archive at 327 MHz, 1.4 GHz, 4.5 GHz and 8.5 GHz for 24 radio galaxies which show X-ray cavities.
 - Reduction and analysis of these multiple frequency radio observations, which we combined with the X-ray data, in order to investigate several fundamental properties of cluster radio sources, including their radiative efficiencies, magnetic field content and particle content.
 - Writing of IDL code to simulate images of clusters with cavities.

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- **Collaborators:** Chris Carilli (NRAO), Paul Nulsen (CfA), Mike Wise (University of Amsterdam), David Rafferty (Ohio University)

- PUBLICATIONS
- *Radiative Efficiency and Content of Extragalactic Radio Sources: Toward a Universal Scaling Relation Between Jet Power and Radio Power*, **Bîrzan, L.**, McNamara, B. R., Carilli, C. L, Nulsen, P. E. J, & Wise, M. W. 2007, ApJ, submitted (www.phy.ohiou.edu/~birzan/papers)
 - *Jet Interactions with the Hot Halos of Clusters and Galaxies*, McNamara, B. R., **Bîrzan, L.**, Rafferty, D. A., Nulsen, P. E. J, Carilli, C. L, & Wise, M. W. 2007, invited review, "Extragalactic Jets: Theory and Observation from Radio to Gamma Ray," held in Girdwood, Alaska, U.S.A. 21-24 May, 2007
 - *Radio Properties of Cavities in the ICM: Imprints of AGN Activity*, **Bîrzan, L.**, McNamara, B. R., Carilli, C. L, Nulsen, P. E. J, & Wise, M. W. in Heating vs. Cooling in Galaxies and Clusters of Galaxies, eds. H. Boehringer, P. Schuecker, G. W. Pratt & A. Finoguenov (ESO Astrophysics Symposia), astro-ph/0612393
 - *A Starburst in the Abell 1835 Cluster Central Galaxy: Self-Regulated Growth of the Bulge and Supermassive Black Hole*, McNamara, B. R., Rafferty, D. A., **Bîrzan, L.**, Steiner, J., Ryan, R., & Sharma, M. 2006, ApJ, 648, 164
 - *The Powerful Outburst in Hercules A*, Nulsen, P. E. J., Hambrick, D. C., McNamara, B. R., Rafferty, D. A., **Bîrzan, L.**, Wise, M. W., & David, L. P. 2005, ApJ, 625, L9
 - *A Systematic Study of Radio Induced X-ray Cavities in Clusters, Groups, and Galaxies*, **Bîrzan, L.**, Rafferty, D. A., McNamara, B. R., Wise, M. W., & Nulsen, P. E. J. 2004, ApJ, 607, 800

- TALKS
- *Radio and X-ray Properties of Cavities in the Hot Atmosphere of Ellipticals, Groups, and Clusters*, Ph.D. talk presented at the AAS meeting in Seattle, WA, January 2007
 - *Radio Properties of Cavities in the ICM: Imprints of AGN Activity*, talk presented at the Heating vs. Cooling in Galaxies and Clusters of Galaxies conference in Garching, Germany, August 2006
 - *Radio Properties of Cavities in the ICM: Imprints of AGN Activity*, invited talk presented at ASTRON, Dwingeloo, The Netherlands, January 2006

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- *Interactions between Radio Sources and the Intracluster Medium: X-ray Cavities*, invited talk presented at NRAO, Socorro, NM, October 2005
- *Interactions between Radio Sources and the Intracluster Medium: X-ray Cavities*, talk presented at the meeting of the Ohio Section of the American Physical Society, Athens, OH, April 2004

POSTERS

- *Interactions between Radio Sources and the Intracluster Medium*, poster presented at the meeting of the High Energy Astrophysics Division of the AAS, New Orleans, LA, September 2004
- *A Chandra Archival Survey of Galaxy Clusters with X-ray Cavities*, poster presented at The Riddle of Cooling Flows in Galaxies and Clusters of Galaxies, Charlottesville, VA, June 2003

SUCCESSFUL PROPOSALS

- *Interactions between Radio Sources and the Intracluster Medium: X-ray Cavities (II)*, VLA proposal, June 2005. PI: Birzan
- *The Origin of Supercavities in the $z = 0.22$ cluster MS0735+7421*, VLA proposal, June, 2004. PI: McNamara
- *Interactions between Radio Sources and the Intracluster Medium: X-ray Cavities (I)*, VLA proposal, June 2004. PI: Birzan

OBSERVING EXPERIENCE

MDM Observatory (2.4-m McGraw telescope):

Total of 8 night over 2 runs (March 2005 and September 2005) with a fellow student from Ohio University as principal observer (without a telescope operator).

Small aperture (0.3-m) telescope:

Used during an observing class at Ohio University, Spring 2003.

OTHER EXPERIENCE

NRAO, Socorro: Interpretation of the VLA radio data with Chris Carilli, May 2006.

NRAO, Socorro: Analysis and interpretation of the VLA radio data with Chris Carilli, March and September 2005.

NRAO, Socorro: Introduction to analysis of VLA radio data with Chris Carilli and a fellow graduate student from Ohio University, December 2004.

NRAO, Greenbank: Introduction in analysis of GBT radio data with Jay Lockman and a fellow student from Ohio University (some experience with AIPS ++ astrophysical software), Fall 2003.

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- SKILLS
- **Writing proposals:** Experience with writing proposals for VLA and some experience with *Chandra* X-ray proposals.
 - **Writing observe files:** Experience with writing observe files for VLA using JOBSERVE.
 - **Observing:** Experience doing broadband and narrowband direct imaging at MDM observatory.
 - **Data reduction and analysis:**
 - X-ray: Extensive experience with *Chandra* X-ray reduction and analysis.
 - Radio: Extensive experience with VLA data reduction and analysis and some experience with GBT data reduction.
 - **Astrophysical software:** Extensive experience with AIPS, CIAO, Xspec and some experience with AIPS ++, IRAF.
 - **Programming languages:** IDL, C++, FORTRAN
 - **Operating systems:** Unix, Linux, Mac OS X
 - **Languages:** Fluent in English and Romanian, fair in French.
- TEACHING EXPERIENCE **Teaching Assistant**, Ohio University (September 2000 – June 2003)
Courses taught: Undergraduate physics laboratories.
- PROFESSIONAL MEMBERSHIPS **American Astronomical Society**, Junior member.
High Energy Astrophysics Division
Sigma Xi, Associate member
- OTHER CONTRIBUTIONS Research featured in the NOVA show *Monster of the Milky Way*, October 31, 2006
- REFERENCES **Brian McNamara**
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