

Resume – Dr. Stefi Baum, 6/1/2006

Dr. Stefi Alison Baum
Director
Chester F. Carlson Center for Imaging Science
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Date and Place of Birth	Dec 11, 1958;	Chicago Illinois
High School	June 1976	Princeton Public High School, Princeton, NJ
College	June 1980	Harvard University, Cambridge, MA B. A. Physics, cum laude
Graduate School	June 1987	University of Maryland, College Park, MD Ph.D. Astronomy

Post-Degree Education

MIT-Sloan Executive Series:

- System Dynamics for Senior Managers
- Managing Technical Professionals and Organizations

Harvard-MIT-Tufts Program on Negotiation, Executive Ed Series:

- Program on Negotiation for Senior Executives
- Dealing with Difficult People and Difficult Situations

Foreign Service Institute

- Global Issues

Expertise

Scientific research expertise in imaging science and astrophysics, specializing in understanding the origin and nature of active galaxies and clusters of galaxies and the development and deployment of observational instrumentation. Well versed in a range of scientific issues and disciplines and the application of scientific, statistical, and engineering methodology. Extensive management and leadership experience, in a range of environments including government, national centers, and academia.

Languages: English – proficient (native language) Dutch – moderate proficiency
French – some proficiency

Security Clearance Top Secret

Management Experience

- Director, Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology. CIS is an interdisciplinary academic education and research center at RIT, supporting undergraduate education, post graduate PhD and masters programs and extensive research activities in a range of imaging fields including remote sensing, astronomy, biomedical imaging, color science, and visual perception.
- Division Head of 140 software developers, testers, systems engineers, scientists and hardware engineers supporting the Hubble Space Telescope (HST) and the James Webb Space Telescope.
- Branch Chief/Team Lead of 25 PhD astronomers and technical staff supporting an advanced scientific instrument for HST, the Space Telescope Imaging Spectrograph.
- Scientific oversight of the HST archive development and deployment.

Direct Government Experience

- American Institute of Physics State Department Fellow, US Dept. of State in the Economics Bureau, Office of Agriculture Biotechnology, and Textiles.

Timeline	Professional Career	Academic Career
7/04 - present	Director, Center for Imaging Science, Rochester Institute of Technology	Full Professor, RIT
11/02-6/04	Senior Science/Diplomacy Fellow, <i>US Dept. of State</i> & American Institute of Physics Diplomacy Fellow Program	leave of absence from STScI
9/02 - ongoing		Co-I & Lead Operations Scientist, NIRCAM on JWST
10/02		Promoted to Full Astronomer, Space Telescope Science Institute (<i>STScI</i>)
11/99 – 10/02	Division Head, Engineering & Software Services Division, <i>STScI</i>	
9/99 -11/99	Deputy, Science and Engineering Support Division, <i>STScI</i>	
1/99 - 9/99		Sabbatical @ <i>Princeton Univ.</i>
2/96 -12/98	Branch Chief, Spectrographs Team, <i>STScI</i>	Awarded tenure 1997 <i>STScI</i>
1/95 – 2/96	Space Telescope Imaging Spectrograph Scientist, Servicing Mission Office, <i>STScI</i>	
10/91 - 1/95	Archive Scientist, <i>STScI</i>	Promoted to Associate Astronomer 1994 <i>STScI</i>
9/90-10/91		Hubble Fellow, <i>Johns Hopkins University</i>
9/87-9/90		Postdoctoral Research Fellow, <i>Netherlands Foundation for Research in Astronomy</i>

Addresses for Employment History

- Carlson Center for Imaging Science, College of Science, **Rochester Institute of Technology**, 54 Lomb Memorial Drive, Rochester NY 14623
- Office of Agriculture, Biotechnology & Trade Policy, Economics & Business Bureau, **US Dept of State**, 2201 C Street NW, Washington DC 20520
- **Space Telescope Science Institute**, 3700 San Martin Dr., Baltimore, MD 21218
- **Johns Hopkins University**, Department of Physics and Astronomy, Bloomberg Center, Homewood Campus, Baltimore, MD 21218
- **Netherlands Foundation for Research in Astronomy**, P. O. Box 2, 7990 AA Dwingeloo, NL

Fellowships and Awards

- American Institute of Physics – US State Department Fellowship 2002/2003
- STScI Individual Achievement Award, for Management/Leadership of ESS, 2002
- Rolex Achievement Award 1999 – given annually to one female and one male college lacrosse player for career achievements supporting society.
- NASA Excellence Award, Hubble Space Telescope Servicing Mission 3A (1999)
- STScI Group Achievement Award, Space Telescope Imaging Spectrograph Team, (1996)
- STScI Individual Achievement Award, Space Telescope Imaging Spectrograph (1996)
- STScI Group Achievement Award, Data Quality Project (1996)
- STScI Individual Achievement Award, Archive Development/Deployment (1993)
- STScI Group Achievement Award, Archive Development/Deployment (1993)
- Annie Jump Cannon Award, awarded annually to a young female astronomer for Scientific Excellence and Promise (1993)
- Junior Research Fellowship, National Radio Astronomy Observatory (1985)

Board and Oversight Committee Active Memberships – active 2006

- Trustee, Universities Space Research Association (USRA)
- VP, Board of Directors, Society for Imaging Science and Technology (IS&T)
- Board of Governors, Great Lakes Research Consortium.
- National Radio Astronomy Observatory Visiting Committee, AUI
- Advisory Board, Program for Innovation and Entrepreneurship, RIT

Professional Societies

- American Astronomical Society
- American Association for the Advancement of Science
- American Institute of Physics
- International Astronomical Union

Astronomical Research

- Space and ground based observations of Active Galaxies, Galaxy Clusters, & High Redshift Systems.

- Analysis and interpretation of the origin and nature of activity in galaxies and the evolution of galaxies and galaxy clusters.
- Principal observational techniques: Optical and ultra-violet spectroscopy and imaging, radio interferometric imaging and spectroscopy, X-ray imaging.
- Over 130 scientific papers published in refereed journals.
- Over 75 professional colloquia given at Universities and Scientific Conferences
- Serve on numerous NASA & NSF scientific review panels for space & ground based observatories.
- Served on Financial Review Committees for HST and for Chandra.
- Served on AAS Employment Subcommittee

PhD Theses Supervised

- Jack Gallimore – “The Kinematics of the Near Nuclear Gas in Seyfert Galaxies” 1995, U. Maryland
- Ed Colbert – “Superwinds in Seyfert Galaxies” 1997, U. Maryland
- Chun Xu – “VLBA and ROSAT Imaging of Nearby Radio Galaxies: Towards Understanding the Nature of Radio Activity”, masters received, PhD on hold, U. Maryland
- Gijs Verdoes-Klein – “Nuclei of Nearby Radio Galaxies: Interplay Between Activity and Galaxy Structure” – 2001, Leiden
- Jacob Noel-Storr – “Kinematics of the Central Regions of Nearby Radio Galaxies: Constraining the Demographics of Black Holes” – 2004, Columbia Univ, NY
- David Russell – “Ultraviolet Observations of Radio Jets: Constraints on Jet Physics” – 2004, University of Manchester
- Avanti Tilak – “Chandra and VLBA Observations of Low Luminosity Radio Galaxies” – current, Johns Hopkins University
- Andrew Michael – “Imaging Deconvolution Algorithms for Radio Interferometric Arrays”- current, Rochester Institute of Technology
- Linpeng Cheng – “Interpixel Capacitance in IR Arrays for Astronomy - Implications for the James Webb Space Telescope”

Postdocs Supervised or Co-Supervised

- Esther Zirbel
- Anton Koekemoer
- Marek Kukula
- Andre Martel
- Catherine Buchanan, active
- Preeti Kharb, active

Meetings Organized

- Analysis of Emission Lines, STScI May Symposium 1993
- Women in Astronomy, IAU General Assembly Session 1994
- NGC1068 – Galaxy, Starburst and AGN 1996
- Galaxies at the Highest Resolution, IAU Symposium 1999

- National Academy of Science workshop on Global Challenges and Directions for Agricultural Biotechnology

External Grant Support

- HST, ROSAT, CHANDRA, SPITZER Science Research grants totaling over \$700,000.00 over ~10 years
 - Active - NYSTAR Faculty Development Grant, PI - \$729,000 5/2006
 - Active NASA Science Grants totaling ~ 200K

Active in 2005-2006 on numerous NASA and NSF Science Review committees

NASA Senior Review
 Chandra Time Allocation Panel
 Spitzer Fellow Selection Panel
 NASA APRA (UV Optical Detectors)
 NRAO Time Allocation Review Panel

Research Synopsis – Stefi Alison Baum

Preamble

I am an observational, extragalactic astronomer, working with ground based optical and radio data as well as space based optical, ultraviolet, and X-ray data. The main focus of my research is the physical nature, origin, and life cycles of activity in galaxies. Activity in galaxies is an interesting phenomenon worthy of study in its own right, but activity in galaxies also serves as a beacon - allowing us to study the evolution of galaxies at redshifts where ‘normal’ galaxies are invisible and providing us with insights into the nature, formation and evolution of the central regions of all galaxies. The evidence has been mounting that activity and galaxy evolution go hand in hand as we now believe that (1) galaxies were assembled coevally with the dramatic evolution in AGN populations, (2) central black holes grew in concert with the growth of galaxy bulges, (3) massive black hole growth was dominated by periods of high accretion producing spinning black holes, (4) star formation always accompanies nuclear activity, and (5) nuclear activity is cyclic. This has established a new paradigm in which galaxy and black hole evolution are tightly coupled.

In my research, I work to understand both the fundamental physical processes responsible for energetic nuclear activity, and the coupling between the formation and evolution of central black holes and galaxy formation. My interest in active galactic nuclei (hereafter AGN) has led me to study powerful radio galaxies, quasars, Seyfert galaxies, starburst galaxies, and normal galaxies. I look for clues in the different manifestations of activity in these different types of galaxies with which to unravel the fundamental mysteries of AGN. What makes a given galaxy turn on as an AGN? Are all galaxies active at some stage in their lives, or are only a small percentage of galaxies capable of extreme nuclear activity? What determines what form activity in a galaxy will take (e.g., powerful radio

source, a luminous ultraviolet source, a starburst instead of a monster) and how is the way the activity is manifested related to the properties of the host galaxy or the presence or physical properties (e.g., size, spin) of a central black hole? What governs the fuel supply to the central source? How does the nuclear activity in a given galaxy evolve with time and how does that evolution affect or parallel the evolution of the host galaxy and its environment? Below I describe some of my key scientific contributions, many of which have been carried out with my graduate students Gallimore, Xu, Verdoes-Klein, and Noel-Storr.

Life Cycles of Active Galactic Nuclei

My thesis research found a tight correlation between the properties of the emission line nebulae and the extended radio emission in powerful radio galaxies (1,2) providing important diagnostics of the interaction of the expanding radio source with its environment. The kinematics of emission line gas in radio galaxies evolves with redshift primarily due to the cosmic evolution in the host galaxies environment (7). At low redshifts, we have used a sample of low luminosity radio galaxies to show that the morphology of the emission line gas and dust reflects the dynamical evolution of the cannibalized gas from a merger which is likely fueling the activity (11). Using HST/STIS (12), we have shown that the kinematics of the nuclear gas, while consistent with an overall rotational pattern, are complex, showing non-rotational motions which may be closely tied to and hold clues to the physics of the fueling of the AGN.

The correlation we (and others) find between emission line luminosity and radio luminosity (2,10) suggests a fundamental link between the power radiated by an AGN accretion disk and the kinetic energy carried by the jets. We presented the first fully relativistic treatment of the surface brightness evolution of expanding relativistic jets and showed that the jets in 3C264 must decelerate as they propagate (4).

There are a range of manifestations of AGN activity and a key problem has been understanding the mechanisms underlying the observed variety. Our work has shown that the rate of accretion onto the central AGN must be an important parameter (3,5). Seyfert galaxies provide local examples of AGN for detailed scrutiny (9). Using VLBI techniques, we have obtained the first image of the ionized inner edge of the obscuring torus-like region (6). We have also shown that the AGNs in Seyferts are capable of driving powerful kpc scale winds (8).

The Complex Cores of Rich Clusters of Galaxies.

The intracluster medium (ICM) of rich clusters of galaxies is rich in complex physics where magnetic fields, hot gas, radiation, stars, and energy input from AGN all play a role (15,16,17, 18). The emission line nebulae provide important constraints on the balance of heating and cooling in the ICM and the ionizing photon field (13). Our searches for cold gas in clusters revealed that the amount of gas cooling and dropping out of the hot ICM is lower than originally estimated (14). Our HST FUV imaging of clusters

has shown that ongoing star formation appears to be a significant sink for any cooling gas and may also dominate the energy budget for the emission line nebulae (15).

List of Key Selected Scientific Publications, referenced above.

1. **S.A. Baum** and T. Heckman, “Extended Optical Line Emitting Gas in Powerful Radio Galaxies: Statistical Properties and Physical Conditions,” *Astrophysical Journal*, 336, 681 (1989).
2. **S.A. Baum** and T. Heckman, “Extended Optical Line Emitting Gas in Powerful Radio Galaxies: What is the Radio Emission-Line Connection?” *Astrophysical Journal*, 336, 702 (1989).
3. **S.A. Baum**, T.M. Heckman, W. van Breugel, “Long Slit Optical Spectroscopy of Emission Line Nebulae in Radio Galaxies: Interpretation,” *Astrophysical Journal*, 389, 208 (1992).
4. **S.A. Baum**, C.P. O’Dea, *et al.* “HST and MERLIN Observations of 3C264 – A Laboratory for Jet Physics and Unified Schemes,” *Astrophysical Journal*, 483, 178 (1997).
5. **S.A. Baum**, E. Zirbel, and C.P. O’Dea, “Towards Understanding the Fanaroff-Riley Dichotomy in Radio Source Morphology and Power,” *Astrophysical Journal*, 451, 88 (1995).
6. J.F. Gallimore, **S.A. Baum**, and C.P. O’Dea, “A Direct Image of the Obscuring Disk Surrounding the Active Galactic Nucleus of NGC 1068,” *Nature*, 388, 852-854 (1997).
7. **S.A. Baum**, Patrick J. McCarthy, “Emission-Line Properties of 3CR Radio Galaxies, III. Origins and Implications of the Velocity Fields,” *Astronomical Journal*, 119, 2634 (2000).
8. **S.A. Baum**, C.P. O’Dea, D. Dallacassa, A.G. de Bruyn, A. Pedlar, “Kiloparsec-Scale Radio Emission in Seyfert Galaxies; Evidence for Starburst-Driven Superwinds?” *Astrophysical Journal*, 419, 553 (1993).
9. J.F. Gallimore, **S.A. Baum**, C.P. O’Dea, “The Sub-arcsecond Radio Structure in NGC 1068: II. Implications for the Central Engine and Unifying Schemes,” *Astrophysical Journal*, 464, 198 (1996).
10. C. Xu, M. Livio, **S.A. Baum**, “Radio-Loud and Radio-Quiet Active Galactic Nuclei,” *Astronomical Journal*, 118, 1169 (1999).
11. G.A. Verdoes Kleijn, **S.A. Baum**, P.T. de Zeeuw, and C.P. O’Dea, “Hubble Space Telescope Observations of Nearby Radio-Loud Early-Type Galaxies,” *Astronomical Journal*, 118, 2592 (1999).
12. J. Noel-Storr, PhD Thesis, “Hubble Space Telescope Spectroscopy of Nuclear Gas Disks in Radio-Loud, Early-Type Galaxies,” Columbia University of NY, 2004
13. T.M. Heckman, **S.A. Baum**, W.J.M. van Breugel, and P. McCarthy, “Dynamical, Physical, and Chemical Properties of Emission-Line Nebulae in Cooling Flows,” *Astrophysical Journal*, 338, 48 (1989).
14. C.P. O’Dea, **S.A. Baum**, P.R. Maloney, L.J. Tacconi, W.B. Sparks, “Constraints on Molecular Gas in Cooling Flows and Powerful Radio Galaxies,” *Astrophysical Journal*, 422, 467 (1994).

15. C.P. O’Dea, **S.A. Baum**, J. Mack, A. Koekemoer, A. Laor, “Hubble Space Telescope STIS Far-Ultraviolet Observations of the Central Nebulae in the Cooling Core Clusters A1795 and A2597,” *Astrophysical Journal*, 612, 131 (2004).
16. A.M. Koekemoer, C.P. O’Dea, C.L. Sarazin, B.R. McNamara, M. Donahue, G.M. Voit, **S.A. Baum**, J.F. Gallimore, “The Extended Blue Continuum and Line Emission around the Central Radio Galaxy in Abell 2597,” *Astrophysical Journal*, 525, 621 (1999).
17. **S.A. Baum** and C.P. O’Dea, “Multifrequency VLA Observations of PKS 0745-191: the Archetypal ‘Cooling Flow’ Radio Source?” *Monthly Notices of the Royal Astronomical Society*, 250, 737 (1991).
18. **S.A. Baum**, “What We Learn About Cooling Flows Through the Study of the 10^4 K Gas in Clusters,” *PASP*, 104, 848 (1992).