AGNES SCOTT COLLEGE
PHYSICS & ASTRONOMY
Volume 1 Summer 2009

INSIDE:

LETTER FROM THE CHAIR

We have had an exciting and eventful year in the Department of Physics and Astronomy at Agnes Scott!

The Physics and Astrophysics majors and minors have been very active this year. Our Society of Physics Students meets regularly, plans community-building social events and contributes to the Decatur community through outreach as well. We had four students present their senior seminar research at SpARC (Spring Annual Research Conference). Two of our juniors studied abroad this year, both in France. And, finally, we had nine graduates this year! Three Math-Physics majors, two Astrophysics majors, an Astrophysics minor, a Physics minor, and two students in the 3-2 Engineering program at Georgia Tech who have completed their Agnes Scott degrees and are continuing on to get engineering degrees.

The department has grown this past year to four full time faculty members. Amy Sullivan joins us from the University of Colorado at Boulder as a Clare Boothe Luce Assistant Professor of Physics. An extra faculty member has allowed us to expand our course offerings and provide additional research opportunities for the students.

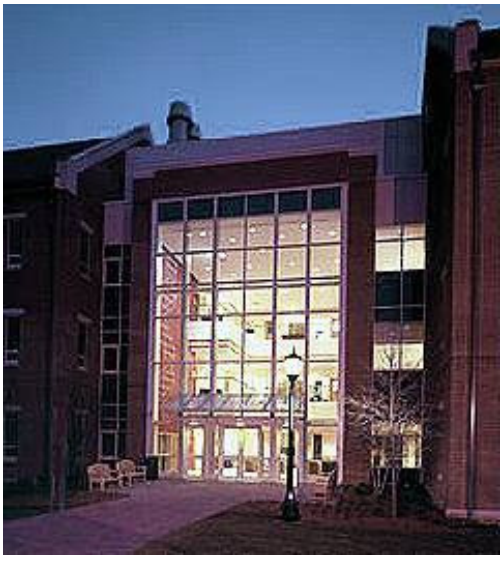
There is a new and improved Physics and Astronomy website online. Please peruse the website for more information on the current news and events in the department. For those of you who are local, please stop by and visit us at Physics Lunch, which meets weekly in Evans or for one of the upcoming events listed below. And don't hesitate to contact any of us with questions, comments, or suggestions.

Sincerely,
Amy Lovell, Associate Professor and Chair

UPCOMING EVENTS

See http://physics.agnesscott.edu for more information

- Metro Atlanta Solar System Dedication on September 11, 2009 at 8 PM
- Laser Interferometer Gravitational Wave Observatory (LIGO) Exhibit in October 2009
- Co-hosting the South Eastern Section of the American Physical Society Annual Meeting November 11 – 14, 2009
- Laserfest activities coming in 2010
- Bradley Observatory 2009–2010 Open House Series *The Galileo Project: Revealing Hidden Worlds*



Faculty Corner

ART BOWLING

Associate Professor of Physics

Art has had a busy teaching schedule this past year, including

- Introduction to Mechanics And Electricity
- Introduction to Magnetism, Heat, Sound and Light
- Analog Electronics
- Digital Electronics
- Methods of Theoretical Physics II
- Electromagnetism.

In addition to having a busy year in the classroom, Art successfully proposed a Course, Curriculum, and Laboratory Improvement (CCLI) grant to the NSF and received funding in collaboration with Gary Gimmestad and Leanne West from the Georgia Tech Research Institute (GTRI) to incorporate an experimental LIDAR (Light Detection And Ranging) system into several of our courses. The grant will support the reinstallation of the LIDAR system at Agnes Scott as well as the incorporation of the system into a number of courses at ASC. Students in various courses, including the new Advanced Lab as well as the introductory courses will get experience with both the LIDAR system itself as well as atmospheric measurements of the Atlanta area. One of our alumnae, Allison Mercer ('03) is also contributing to this project as she works towards her PhD at GTRI.

CHRIS DE PREE

Professor of Physics & Astronomy & Director of Bradley Observatory

Chris taught:

- The Solar System
- Scientific Computing
- Thermal Physics

and co-taught a course with Columbia Seminary Professor Mark Douglas entitled "The End of the World in Science and Religion". The class incorporated students from both ASC and Columbia Seminary, which provided for many cross-disciplinary discussions.

In Spring 2009, Chris was promoted to Professor of Physics & Astronomy. Spring also marked the start of many local International Year of Astronomy (IYA) activities, including the 100 Hours of Astronomy event co-sponsored by the Atlanta Astronomy Club (AAC) in April, and the dedication of the From Earth to the Universe images at the Atlanta airport in May 2009. Chris was co-I on a NASA grant that funded the installation. If you're in the Atlanta airport this fall, check them out! Chris also attended two professional meetings during the academic year. The first was "Assembly, Gas Content and Star Formation History of Galaxies", The Fourth North American ALMA Science Center Conference, September 2009 in Charlottesville, VA. He also presented his research on star formation using data from the Gemini Telescope at the American Astronomical Society (AAS) meeting in Long Beach, CA in January 2009. This research has been accepted for publication in the Monthly Notices of the Royal Astronomical Society (MNRAS). In May 2009, Chris traveled to New Mexico to present an invited colloquium talk at the Very Large Array (VLA).

Faculty Corner

AMY LOVELL

Associate Professor of Physics & Astronomy
Department Chair

Courses taught 2008 – 2009:

- Galaxies And Cosmology
- Astrophysics II: Dynamics
- Senior Seminar

as well as a First Year Seminar on Energy, and an interdisciplinary Global Connections course entitled Archeoastronomy in Mexico with Martha Rees from Anthropology.

Amy (Lovell) has been serving as the chair of the department for the 2008 – 2009 year, directing the college's Center for Teaching and Learning, and serving as the faculty advisor for the Society of Physics Students (SPS). She also continues to serve on the National Radio Astronomy (NRAO) User's Committee. Amy traveled in May with Mary Hinkle to NRAO in Green Bank, West Virginia, to help plan for future comet observations and new high-frequency instruments for the Green Bank Telescope (GBT). She served as an instructor for the radio astronomy Single Dish Summer School, held at Arecibo Observatory in Puerto Rico in July. On this trip, she was happy to reunite with Ashley Zauderer '02, who was attending the school as a graduate student from the University of Maryland.

In addition to research and ASC activities, she has been busy helping out with the Bradley Observatory Open House series and giving planetarium shows to local school children.

AMY SULLIVAN

Clare Boothe Luce
Assistant Professor of Physics

Amy Sullivan taught:

- Labs for both the Introduction to Mechanics And Electricity, and the Introduction to Magnetism, Heat, Sound and Light courses
- Modern Physics
- Optics (a new course)

Amy has traveled quite a bit this year – to give an invited talk at Frontiers in Optics, the annual meeting of the Optical Society of America in Rochester, NY in October 2008, the Physics Diversity Summit in Nashville, TN in February 2009 and a New Physics Faculty Workshop sponsored by the American Association of Physics Teachers in College Park, MD in June 2009. She also went on a trip to Prague last November, but that was really just for fun.

In between traveling and teaching, she has been setting up an experimental optics research lab. She has successfully proposed an NSF research grant in collaboration with Tom Gaylord in the School of Computer and Electrical Engineering at Georgia Tech to work on the design and fabrication of photonic crystal devices. This summer, she is working with Melissa Meister on a new method of three-dimensional imaging of optical devices. She recently had a paper published in the May 15, 2009 issue of *Science* on a new type of nanofabrication using polymers.

Astronomy Events

This year's open house series focused on Astronomy before Galileo. The open house series offers wonderful talks by local speakers, planetarium shows, and telescope viewing for the local community. Listed below are the l topics offered this past year. Keep posted for next year's events at http://bradley.agnesscott.edu/openhouse.html.

BRADLEY OBSERVATORY
OPEN HOUSE SERIES 2008 – 2009

September 19, 8 PM
William A. Calder Fall Equinox Concert & Open House
Tracy Laird (ASC)
"Songs from Space: Aliens, UFOs and other Intergalactic Themes in American Music"

October 10, 8 PM
Professor Hal Thorsrud (ASC)
"What's your sign? Ancient arguments against astrology"
Doors open at 7 PM for "Moon Festival" activities (sponsored by the Japanese Cultural Events Committee)

November 14, 8 PM
Amy Lovell (ASC)
"Venus and Meso-American Astronomy"

December 12, 8 PM
Chris De Pree (ASC)
"Tycho Brahe and Uraniborg"

February 13, 8 PM
C. De Pree (ASC)
"From Earth to the Universe: Astronomical Images for the International Year of Astronomy"

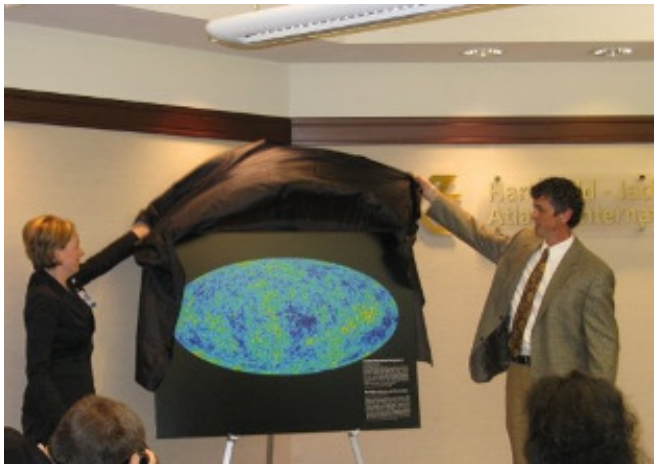
April 3, 8 PM
"100 Hours of Astronomy" Celebration

May 8, 8 PM
Bill Brown (Columbia Theological Seminary)
"The Heavens are Telling the Glory of God": The Cosmos According to Ancient Israel

EARTH TO THE UNIVERSE EXHIBIT

Hartsfield-Jackson Atlanta International Airport
May 4, 2009 – December 31, 2009

From Earth to the Universe (FETTU) is a collection of astronomical images that showcases the most dramatic views of our universe. The images, which represent the incredible variety of astronomical objects that are known to exist—planets, comets, stars, nebulae, galaxies and the clusters in which they congregate—will be exhibited in numerous locations throughout the world in 2009. These exhibits, held in public parks, airports, art centers and at other unique sites bring the wonders of the universe right to you.



Physics Phun

APRIL PHOOL'S DAY

The traditional April Phool's Day pranks are going strong with a very enthusiastic and industrious group of majors and minors in the department. The creativity and work put into this year's pranks can really only be properly described in pictures…

CURRICULUM CORNER

In addition to pranks and general mayhem, this year students had the opportunity to take some interesting topics and new classes. There were two topics classes this year, a First Year Seminar on Energy taught by Amy Lovell and a topics class entitled The End of the World in Science and Religion taught by Chris De Pree jointly with Mark Douglas from the Columbia Theological Seminary. The End of the World course included students from both Agnes Scott College and the Columbia Theological Seminary. We also offered a new Optics course taught by Amy Sullivan, which will continue to be a regular offering in the department.

With the new Optics offering as well as a new Advanced Lab offering beginning in Spring 2010, we have modified the degree requirements to allow for greater flexibility for both Physics and Astrophysics majors. This will give them the opportunity to study a wider variety of topics as well as have more scheduling flexibility that will make it easier to study abroad.

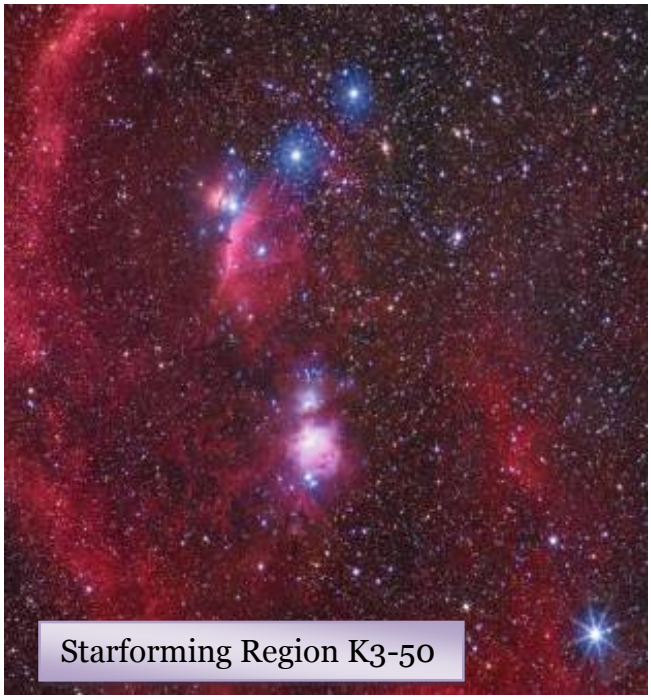
For more on classes and new course requirements, check out our website: http://physics.agnesscott.edu/

Spring Annual Research Conference (SpARC)

Broad Lines and Outflows in the Massive Star Forming Region K3-50

Author: Allison Smith, Advisor: Professor Chris DePree

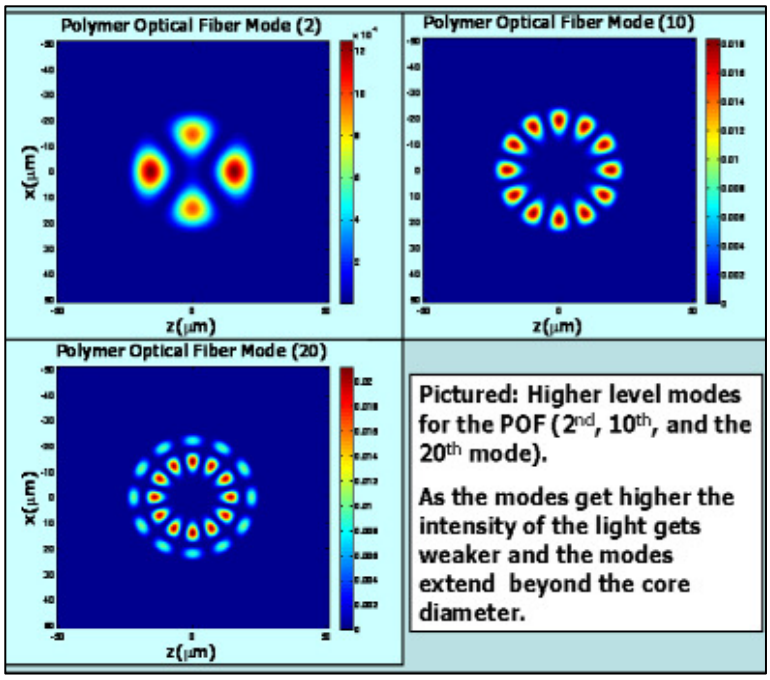
I present line and continuum radio observations with the Very Large Array (VLA) of the massive starforming region K3-50. K3-50 consists of four sources (K3-50A-D) with a variety of morphologies. Observations of broad recombination line sources (BRLOs) and bipolar outflow sources suggest that accretion disks may be a factor in high mass star formation. The bipolar BRLO source A is known to be undergoing a high-velocity bipolar outflow (DePree, 1994). Sources B and D are diffuse, while the compact sources C1 and C2 could also be classified as BRLOs. We use multi-frequency VLA data to determine whether the C sources have broad spectral lines and rising spectral indices and can be classified as BRLOs. We use the velocity gradient across the minor axis of the system to calculate K3-50A's enclosed mass. This method is used for comparison with the mass estimates from a previous analysis by Howard et al. (1996).



Starforming Region K3-50

Comparative Analysis of Glass, Photopolymer, and Integrated Silicon Optical Fiber Modes

Author: Shayla Otolorin, Advisor: Professor Amy Sullivan



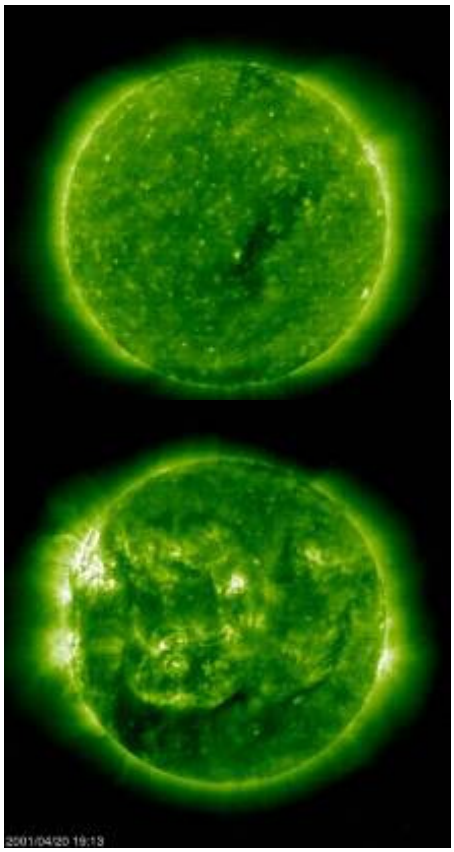
Fiber optic communications is a rapidly growing field in which technology to yield efficient information transmission is continuously studied. Glass is currently the most widely used technology for making optical fiber; however microstructuring and polymers are widely researched for integrated optics. Both polymer fibers and microstructured fibers have various advantages and disadvantages stemming from the capabilities and limitations of the materials. In this presentation the polymer fibers, microstructured fibers, and traditional glass fibers will be compared through the analysis of wave propagation models. Using MATLAB programming, waveguide models will be constructed and their modes graphically analyzed.

SpARC Abstracts

Magnetic Field Reversals

Author: Arielle Newgard, Advisor: Professor Amy Lovell

The most common view of the Sun's magnetic field is as a perfect dipole field that is often drawn as a butterfly pattern around the Sun. The closer the Sun gets to solar maximum, an increasing number of regions with the opposite polarity of their hemisphere start to occur. The turbulent magnetic field of the Sun leads to such phenomena of sunspots and coronal holes. By studying coronal holes, we learn that the non-uniform rotation of the Sun causes the ultimate flip of the magnetic field. This leads to the question of what research needs to be done to evaluate the time scale of the Earth's magnetic field reversal.

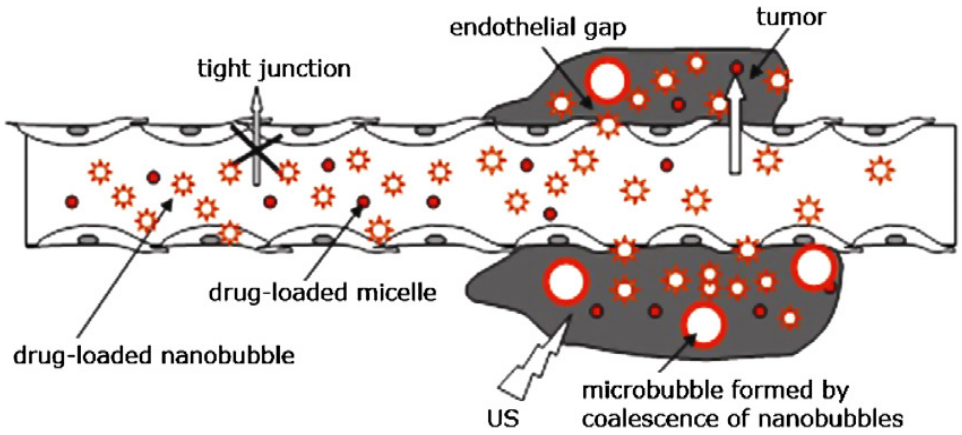


Solar images taken at 195 Å (1.5 million K). Time of few sunspots (top) and high sunspot activity (bottom).

Ultrasonic Technologies in Medicine, Particularly the Manipulation of Microbubbles

Author: Rachel Klaeren, Advisor: Professor Amy Lovell

Research into ultrasound technology and its use in the medical field is growing, particularly in the area of sonodynamic therapy and the applications of sonoporation. High intensity ultrasound can cause the cavitation of microbubbles, resulting in modification of the permeability of cell membranes or in complete cell death. Using ultrasound to weaken the membranes allows for the better delivery of drugs. In other instances, micro and nanobubbles containing the drug are introduced to the malignant cells and then ultrasound triggers cavitation and collapse, releasing the drug within the cell, maximizing effectiveness. These advances are being applied in gene therapy, and in various cancer treatments such as induced apoptosis and chemotherapy.



Summer Research

Summer Research Group starting a hike at Stone Mountain Park.

A group of biologists, chemists and physicists gather weekly in the summer to discuss research, go on a hike, or volunteer at the local food bank together.

SUMMER RESEARCH

Several Agnes Scott Physics majors are doing research this summer, both on and off campus.

On campus, Melissa Meister is working on imaging optical fibers using diffraction tomography with Amy Sullivan. Mary Hinkle is working with Amy Lovell on simulations for studying comets.

Off campus, Hannah Marlowe is doing research through an NSF funded Research for Undergraduates (REU) program at Rensselaer Polytechnic Institute in Troy, NY. Sarah Dhalla is at Florida International University in Miami, working on a project on Blazars through the REU program of SARA (Southeastern Association for Research in Astronomy). She went to Kitt Peak in Arizona to use the telescope earlier in the summer.

Mary Hinkle and Prescence O'Neal also received travel grants to attend the 2009 Citizen Sky workshop in Chicago in August.

Leda Sox from Paris...

"Spring semester, I took a break from Physics and went to Paris to study French language and culture. Since it was my first time in Europe, I also did a whole lot of traveling."

Society of Physics Students

- Meetings every other week
- Outreach
  - Planetarium show for Boy Scouts
  - Winnona Park Elementary School
    - set up telescopes for students at their sleepover
- Camping trip in fall
- April Phool's Phun
- On campus lecture:
  - Theresa Brunasso, Director of Technology Development at EMS Technologies Defense & Space Systems gave a wonderful talk entitled "Searching for Martians."

ALUMNAE UPDATE

We would love to hear what you've been up to recently. Where are you currently? Are you in graduate School? Are you working? Are you married? Do you have children? Have you traveled to any interesting places recently?

We would also like to collect a list of "after my physics/astrophysics degree" careers as a resource for our current students. In addition to sending us information on your current whereabouts, if any alumnae are interested in communicating with current students about career options or about specific careers, please let us know. Send your update to Amy Sullivan at asullivan@agnesscott.edu. Or, if you prefer, mail to Amy Sullivan, Department of Physics and Astronomy, 141 E. College Ave., Decatur, GA 30030.

And, of course, if you're in town, please stop by and join us for any of our many events for the upcoming year or just come by and visit!

Graduation

THE PHYSICS & ASTRONOMY CLASS OF 2009

Allison Smith
- Astrophysics major
- Starting graduate school at the University of Georgia at Athens

Rachel Klaeren
- Math/Physics major
- Teaching science at the Academy at the Lakes, in Land O' Lakes, FL

Shayla Otolorin
- Math/Physics major
- Working at the Georgia Tech Research Institute

Valentina Dimitrova
- Math/Physics major
- Working in a biology research lab at the University of Chicago

Arielle Newgard
- Astrophysics major
- Starting graduate school at the University of Missouri

Jenny Ryu
- Math/Physics major
- Mechanical Engineering at Georgia Tech with the 3–2 Engineering Program

Jenny Tuggle
- Astrophysics major
- Aerospace Engineering at Georgia Tech with the 3–2 Engineering Program

Ivy Fitzgerald
- Physics minor
- Starting graduate school in Biophysics at the University of Chicago

Graduation! (above)
From left to right: Rachel Klaeren, Jenny Tuggle, Allison Smith and Jenny Ryu at graduation.

Celebrating our graduates (below):
From left to right: Chris De Pree, Ivy Fitzgerald, Amy Lovell, Rachel Klaeren, Crystal Keddie-Hill, Jenny Tuggle, Jenny Ryu, Art Bowling, Allison Smith, Arielle Newgard, and Amy Sullivan