

Photosynthesis Discovery Could Lead to Design of Efficient Solar Cells

Dr. Gary Hastings and Hiroki Makita of Georgia State University recently found that a natural process that occurs during photosynthesis could lead to the design of more efficient artificial solar cells.



Dr. Hastings

During photosynthesis, plants and other organisms, such as algae and cyanobacteria, convert solar energy into chemical energy that can later be used as fuel for activities. In plants, light energy from the sun causes an

electron to rapidly move across the cell membrane. In artificial solar cells, the electron often returns to its starting point and the captured solar energy is lost. In plants, the electron virtually never returns to its starting point, and this is why solar energy capture in plants is so efficient. A process called inverted-region electron transfer could contribute to inhibiting this “back electron transfer.”

This study’s findings, published in the journal Proceedings of the National Academy of Sciences, provide quantitative evidence that inverted-region electron transfer is responsible for the very high efficiency associated with solar energy conversion in photosynthesis. To read the study, visit <http://www.pnas.org/content/114/35/9267>.

The study was funded by the Qatar National Research Fund. Dr. Hastings received another two-year federal grant award to study solar energy conversion in photosynthesis. Read more about that from: a GSU press release.

Department Highlights (2017)

Dr. Unil Perera and his team discovered an infrared spectroscopy-based blood test for ulcerative colitis.

Dr. Todd Henry became the Principal Scientist for the SMARTS (Small and Moderate Aperture Telescope System) Consortium.

Dr. Brian Thoms’s leadership in physics education lead to the “5+ Club” Award to GSU for 2016-2017 by American Physical Society’s Phys-TEC program.

Dr. Theo ten Brummelaar of CHARA won NSF funding to add new instruments both at the telescopes and in the beam combining laboratory.

Dr. Mark Stockman and his team discovered that microscopic lasers may stop tumours spreading around the body.

Dr. Crenshaw was appointed Chair of the Board of Governors of the Astrophysical Research Consortium.

Dr. Brian Thoms won outstanding Undergraduate Director award.

Zachary Hartman won a Chambliss Astronomy Achievement Award for his work.

Tristan Haseler, working with Dr. He and our nuclear physics group, is featured in an article of Brookhaven National Laboratory.

For more news, visit: P&A news webpage.

Department Chair’s Message

Welcome to the 5th edition of our annual Departmental Newsletter. We hope that you enjoy reading about the accomplishments and goals of our faculty, staff, and students. Our faculty members and students continue to make groundbreaking discoveries in physics and astronomy. The accomplishments of two of our faculty members are described on page 2. On this page, we highlight the research of our biophysics faculty member, Dr. Gary Hastings.



A few selected highlights of this past year are listed above - many more can be found on the home page of our department website: <http://www.phy-astr.gsu.edu>. Feel free to contact us by email and/or arrange for a visit.

Sincerely,

Dr. D. Michael (Mike) Crenshaw

Faculty and Event Highlights

Dr. Xiaochun He



Dr. Xiaochun is a Distinguished University Professor. He is an experimental high-energy nuclear physicist. He is a member of the PHENIX and the sPHENIX Collaboration at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory, which is the major high-energy nuclear physics facility in the world. He is also a leading member of the Particle Identification Detector Consortium of the Electron-Ion Collider (EIC) project, which is the planned major research facility of the US Department of Energy Office of Nuclear Physics. His main research areas include the study of the properties of Quark-Gluon Plasma created in heavy-ion collisions, the tomography of the nucleon and nucleus structure at EIC, the cosmic ray flux variations and the associated applications (cosmic ray muon tomography, cosmic ray effects on climate change, etc.). In addition, he is interested in developing radiation-hard sensors and detectors for nuclear and particle physics experiments and for medical physics research. He has published 200 scientific papers and has more than 70 conference presentations and invited talks. He supervised 12 PhD students in completion and is presently working with 7 PhD students and one post-doc. He also serves as the Graduate Director for Physics.

Dr. Fabien Baron



Dr. Fabien Baron is an expert in interferometry and image reconstruction. Using a variety of methods like compressed sensing, Dr. Baron has created some of the highest fidelity and most detailed maps of the surfaces of stars, and the algorithms and methods that he has developed have won several "Beauty Contests" among image reconstructionists. Dr. Baron joined the GSU astronomy group in April 2013, and he has recently been recognized with the Dean's Early Career Award in the College of Arts and Sciences. He is currently involved in a variety of projects that rely on GSU's CHARA array, and he is a member of the Event Horizon Telescope team as well.

The Sun In the Shadow of the Moon

To put themselves in the path of the total eclipse of the sun, 10,000 people inched along two-lane roads leading to the picturesque campus of Rabun Gap-Nacoochee School, the site of the OutASight Eclipse Festival co-hosted



by the Georgia State University Astronomy Department and the Rabun Gap Tourism Development Authority. They traveled from nearby cities like Atlanta and from distant states like Texas and California to this small, mountainous corner of Georgia.

"When we first started planning this event we thought we might get 1,000 people," said Dr. Ben McGimsey, astronomy lecturer at Georgia State. "We had no idea."

In front of a large screen broadcasting live footage from Oregon, Wyoming, Kansas and Kentucky, spectators watched and waited as the solar eclipse

raced eastward from the Pacific Coast at more than 1,000 miles per hour. To pass the time, they peered into Georgia State's solar telescopes, ate tomato sandwiches and ice cream cones, listened as university astronomers answered questions from the crowd and made pinhole cameras from cardboard tubes. Read more about the eclipse party here: <http://news.gsu.edu/2017/08/23/shadow-of-the-moon/>

New Members, Outreach and Other Activities

Dr. Jane Pratt

Dr. Jane Pratt joined the Department of Physics and Astronomy at Georgia State University as an Assistant Professor in the fall of 2017. She was previously working as a postdoc in the astrophysics group at the University of Exeter, and prior to that she worked on tokamaks and fusion reactors with the Dutch Institute for Fundamental Energy Research and the Max Planck Institute for Plasma Physics. Dr. Pratt's current research is in the field of Computational Astrophysics and Plasma Physics. She studies the interiors of low-mass stars and the interstellar medium using magnetohydrodynamic models to understand how



fundamental plasma physics like turbulence, magnetic instabilities, convection, and the dynamo contribute to stellar evolution and space weather. Welcome Dr. Pratt!

Ms Catrice Fraser

Catrice Fraser is an Administrative Specialist and provides administrative support to the department in relation to sponsored accounts. She joined the department in March of 2017. Catrice was born and raised in Atlanta, Georgia and graduated from Georgia State University. She has enjoyed being back at her alma mater. Outside of work, Catrice enjoys spending time with her husband and two children. Welcome Catrice!



Undergraduate women in physics

The American Physical Society's Conferences for Undergraduate Women in Physics (CUWiP) is designed to encourage undergraduate women to continue pursuing a career in physics by providing them with in-



formation and advice about the different areas of physics and astronomy research, gaining research experience, applying to graduate school, networking skills and opportunities outside of academia. On January 12, Dr. Megan Connors, the advisor for the GSU Women in Physics group, drove a van of GSU physics majors to the three day regional CUWiP hosted by the University

of North Florida in Jacksonville. Students in the photo are Kara Gartner, Kristin Baker, Emily Knutson, Ivy Tran, Sarah Johnson and Nyla Peterson. It was a great experience for the students and we hope to encourage even more GSU participation next year.

Science Olympiad

In 2017 also, as in the previous years keeping the tradition and dedication alive, many of our physics and astronomy faculty and students ran Science Olympiad for middle school students from all over the greater Atlanta areas.

SPS and PGSA activities

The Society of Physics Students (SPS) at GSU co-organized the annual honors awards ceremony on April 21st, 2017. On May 6th 2017, the SPS and the Physics Graduate Student Association (PGSA) co-organized the annual departmental picnic at Indian Creek Recreation Center.

International teaching and research lecture

Dr. Mukesh Dhamala taught an educational course and delivered a conference lecture on neurophysics research in BrainModes 2017 conference held in India last year. He was also chosen as the next chair of the organizing committee for BrainModes 2019.



CHARA meeting

The GSU CHARA Array is improving its views of stars through the addition of adaptive optics. The CHARA team met at Mount Wilson in California in September to discuss these new developments and other prospects for the future of the Array. Be sure to visit the CHARA Array if your travel plans take you to southern California.



Participation and Support Opportunities

- Visit us online at <http://phy-astr.gsu.edu> and view our schedule of public events and colloquia: upcoming events
- Visit Hard Labor Creek Observatory (HLCO), which is located about 50 miles east of downtown Atlanta. There are free public open houses to this facility.



- Follow us on social media: facebook, twitter

- Contact us at:

Department of Physics & Astronomy
Georgia State University
25 Park Place, Suite 605
Atlanta, GA 30303
Phone: (404) 413-6033
Fax: (404) 413 - 5481



There are a number of ways to support Physics and Astronomy at GSU through giving:

- Endow an undergraduate scholarship or award in physics and/or astronomy. Set up a general fund or fine-tune the award to a specific field of research, disadvantaged students, etc. (An example is the annual Robert H. Hankla Award for Outstanding Physics Major.)
- Set up an endowment for a graduate research fellowship in your field of interest or contribute to an existing annual student award in physics or astronomy (see <http://phy-astr.gsu.edu/about/awards-honors/>).
- semester-long visit or a Distinguished Speaker Series. (An example of the latter is the William H. Nelson Fund.)
- Endow a professorship or postdoctoral fellowship in a specialized field. Learn more about the research our faculty are doing from their individual webpages.
- Help to establish new facilities or enhance existing ones. (Examples include partnerships in large telescope consortia, or the new CeNO).
- Contribute directly to the general fund of our Department (go to: <https://netcommunity.gsu.edu/give-annually> and specify fund code 02041). Contributions support faculty, staff, and students, professional and social functions, and recruitment.
- For more information about giving, visit <http://phy-astr.gsu.edu/connections/giving>, or contact the College Development Office (Chad Dillard, Assistant VP for Development, 404-413-5739, cdillard@gsu.edu), or contact our Chair, Dr. Mike Crenshaw (404-413-6036, crenshaw@phy-astr.gsu.edu).



- Fund a Visiting Distinguished Scholar for a