

American Chemical Society: Rising Star Award

October 28, 2015



Karelle Aiken, PhD

Prof. Karelle Aiken's star is rising and the American Chemical Society has recognized this and has awarded her the Women in Chemistry Committee Rising Star Award for 2016. This prestigious, national award recognizes up to ten remarkable women scientists approaching mid-level careers who have demonstrated outstanding promise for contributions in their respective fields.

The award distinguishes Aiken, Associate Professor of Chemistry at Georgia Southern University, for her outstanding work and mentorship with undergraduate students, graduate students, and new faculty. Aiken came to Georgia Southern in 2007 and quickly gained a reputation as an outstanding mentor.

Her office and laboratory are busy with students engaged in research projects ranging from synthesis of organic compounds with promising pharmaceutical applications to creative molecular sensors with defined applications. Aiken believes strongly in the value of a research-based education. One of her former research students, Senior Zachary Lee, said that Aiken "believes in her students and has a lot of faith in what they are capable of doing. She pushes you hard and does not give you the answer. Dr. Aiken will challenge you to figure out the answer and does not move on until you have done so."

This approach to teaching and mentoring is based in Aiken's own experiences from those who guided her on her own scientific journey. In her mind, the greatest lesson given by a mentor is, "You can seek to be great at science, but you must extend kindness to your students and act with integrity at every step of the way. High expectations and challenging work will foster students' growth, helping them to reach a level that even the students themselves cannot foresee."

Her passion for research and mentoring found her leading the departmental summer research experience for undergraduates 2012-2015 which with NSF funding (2015-2017) now incorporates an REU program, CEMITURE. The summer program has included intense laboratory work as well as training workshops on grant writing, fellowship applications, scientific presentations, and planning for future employment. Aiken was a founding advisor for the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) chapter at Georgia

Southern University. Several of her students have won awards for their presentations at the NOBCChE's national meetings. Aiken has also published papers in internationally-recognized and peer-reviewed scientific journals with her students, several of whom have gone on to pursue postgraduate degrees in the chemical and medical sciences.

Aiken has had an immeasurable influence on the lives of hundreds of students through her hands-on teaching and research mentoring. She has positively influenced her department and university by leading new faculty and taking on service roles that enhance the quality of her work environment. She is a positive force for the development of young researchers and redefines the nature of the scientist. Prof. Aiken's light is shining brightly at Georgia Southern University as a Rising Star Award winner for 2016.

Learn more about the [Women Chemists Committee](#)

Dr. Maxim Durach Nanotechnology Computational Group Update

February 1, 2016



*Physics Nanotechnology Computation Group.
Dr. Durach with graduate students Matthew LePain and David Keen, undergraduates Shane Kearney and Reed Hodges*

Two major results have been obtained by the Nanotechnology Group, led by Dr. Maxim Durach. In a paper by Applied Physical Sciences graduate students David Keene and Matthew LePain and Dr. Durach it is shown that 30-nm thick monolayer metal-dielectric metasurfaces can drastically modify the properties of radiation passing through them and entirely change the spin state of the constituent photons. In their manuscript (arXiv:1512.08139, "Ultimately Thin Metasurface Wave Plates"), submitted for peer-review, they show that the extreme anisotropy of the proposed metasurfaces sets the ultimate lower limit for the thickness of optical

waveplates. This result can be applied to the design of ultrathin wave plates, Pancharatnam-Berry phase optical elements and plasmon-carrying optical torque wrench devices.

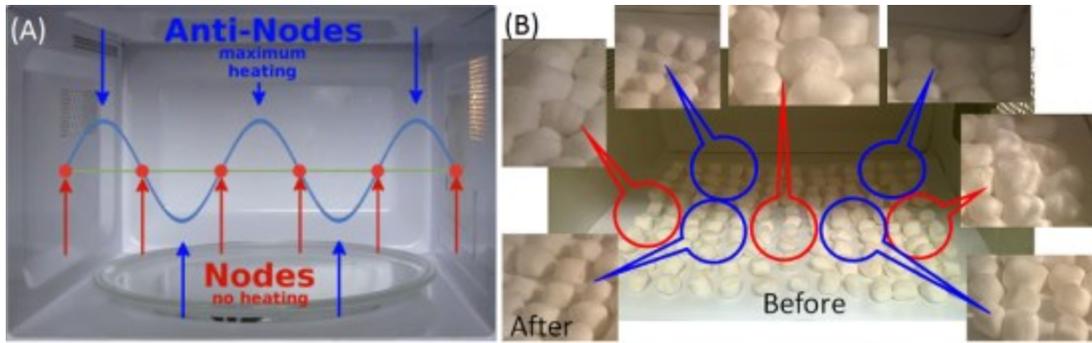
Another important result is achieved in understanding of the nature of plasmonic drag effect (PLDE) in collaboration with Dr. Natalia Noginova from Norfolk State University. In their manuscript

(arXiv:1601.06350, "On Nature of Plasmonic Drag Effect"), submitted for peer-review, they propose a mechanism of PLDE, the generation of enhanced electric currents under conditions of surface plasmon resonance, based on hot-electron-mediated plasmonic pressure model, which explains the observed in experiments relationship between the plasmon drag electromotive force (emf) and absorption and emphasizes the quantum plasmonics nature of PLDE. They were able to correctly calculate the magnitude of the emf in flat metal films for the first time, by taking the hot-electron momentum thermalization into account. This result is promising for applications in industry and biomedical field, since PLDE offers a new operational principle for hybrid plasmonic-electric circuitry, biosensors, detectors and imaging."

Microwave Ovens Are Not Just Kitchen Appliances

February 1, 2016

While for most of us microwave ovens are nothing but kitchen appliances used to "nuke" our breakfast, for Dr. Amarie's students in Studio Physics 2 (Electricity, Magnetism and Optics) they are laboratory instruments. For them, the oven is a microwave resonant cavity capable of sustaining stationary electromagnetic waves (schematics, Figure A) in the microwave range characterized by nodes (cold spots) and anti-nodes (hot spots) similar to a vibrating guitar string when we play a note. But how to make the invisible waves visible, is the question? Well, we chose a very delicious approach: a platform covered first with a pattern of marshmallows (Figure B), then with Hershey's chocolate bars "revealed" the hot spots as they melted (Figure B – inserts) and measurements were possible. To our surprise, given such a crude method, we determined a wavelength of 12.5 cm (5 inches), give or take a marshmallow, which comes within about 2% of the theoretical value of a 2.45 GHz microwave oven. As you can imagine the demo was a blast, we had to take advantage of the situation and since graham crackers started to show up out of the well-prepared students' backpacks, the s'mores time was on! See? Physics is so sweet!



Safety Comes First

Microwave Irradiation is concerning us all. Dr. Amarie's students in Studio Physics 2 (Electricity, Magnetism and Optics) were excited to learn about the microwave radiation levels to which we are exposed to in diverse situations. But even if we would have means to perform experimental measurements, how can we tell when enough is enough? What are dangerous exposure levels? The instructor guided his students towards federal agencies like FDA and CDC which have set standards for microwave radiation safety since the 70's. For example, we learned together that microwave ovens have a "safety interlock [...that] shall prevent microwave radiation emission in excess of 5 milliwatts per square centimeter at any point 5 centimeters or more from the external surface of the oven" [FDA – Code of Federal Regulations, Performance Standards for Microwave and Radio Frequency Emitting Products. (2015) 21CFR1030]. Armed with valuable knowledge, we started to explore our environment. As expected, we found the largest microwave intensity close to the oven. Our findings showed that in front of the oven's door the radiation is maximum, and about 0.2 mW/cm^2 , which is still $25\times$ less than the federal requirement for safety. Next, we explored our classroom. Numbers seemed to vary quite randomly with values between $2.0 - 10 \text{ nW/cm}^2$, no matter the location: close to the fuse box, the PC monitor or under classroom projectors. Such measurement were very close to natural background measured in the park in front of the Math/Physics Building, roughly 1.0 nW/cm^2 . Since all our cell phones emit in the microwave range, the next biggest attraction was about how much exposure we get when we make a call? To answer such question, over 50 students simultaneously called instructor's office phone, than immediately placed their smartphones, on top of each other, within 2-3 inches of the detector. Students' learned that every time we make a phone call, we are exposed to an average microwave intensity of about 5 uW/cm^2 or 1,000 times less than the federal requirement. Let's hope these experiments put some minds at rest.

