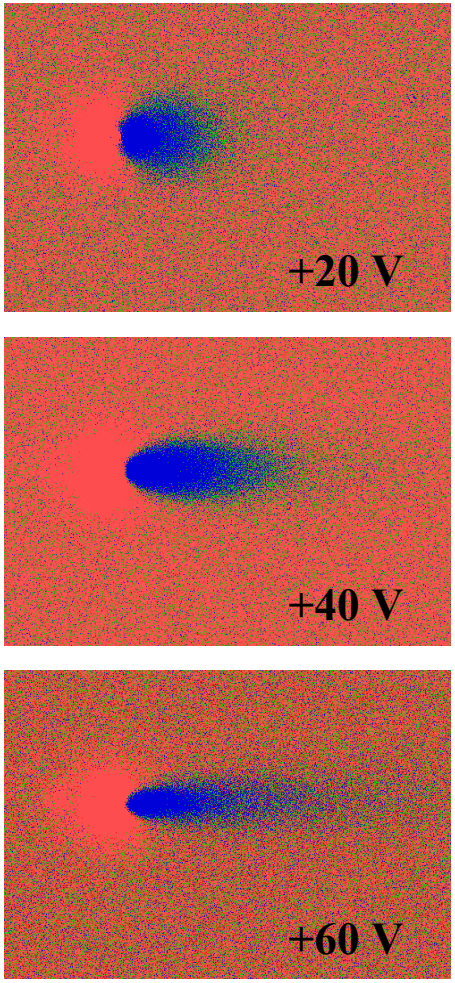
Imaging Transport: From the Motion of Charge to the Detection of Light

Nancy M. Haegel, DMR-0203397
Fairfield University, Naval Postgraduate School

We have demonstrated the use of a scanning electron microscope, in combination with an optical microscope and high sensitivity CCD camera, to directly image the motion of charge carriers in semiconductors and other luminescent materials. The charge is generated at a point and the subsequent motion caused by diffusion or electric fields can be observed in real time. The images at right show charge motion in GaAs with increasing electric field. The comet-like structure shows how the charge motion becomes increasingly elongated in the direction of the field, which is applied from left to right. The technique can be applied to any luminescent material.



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Nancy M. Haegel has been awarded the 2004 APS Prize for Research at an Undergraduate Institution. The award citation reads..

"For her important contributions to semiconductor materials and semiconductor device physics, and for enthusiastic and sustained involvement of undergraduates in her research efforts at Fairfield University."

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Education:

Prof. Haegel's research group at Fairfield University was comprised solely of undergraduate students, working in the areas of semiconductor detectors and semiconductor transport. Two students (Jose Simoes and Matthew Smylie) were recipients of Goldwater Scholarships. Mr. Smylie, a 2002 graduate, is currently on a Fulbright Fellowship at the Max Planck Institute for Extraterrestrial Physics. Other students have gone on for graduate study at Yale, Harvard and Cornell Universities. Several are currently working as fully certified high school physics teachers.

Outreach:

With science teacher Pattie Hunt, Dr. Haegel created a curriculum enhancement program entitled "Science and the Citizen." Using current issues in science and technology, students at Ludlowe Middle School studied science and benefited from exposure to speakers on opposing sides of public policy debates. The program included speakers, field trips and one-one-one interactions with college students.