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**The Technology Forum of the  
SPECTROSCOPY SOCIETY OF PITTSBURGH**

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**— OCTOBER MEETING —**

Wednesday, October 17, 2007

5:30 p.m.

Duquesne University

Mellon Hall of Science (Laura Falk Hall)



**Dr. David Snoke**

University of Pittsburgh

Department of Physics and Astronomy

**”Lasing Without Inversion: Bose-Einstein Condensation  
of Polaritons in Semiconductor Microcavities”**

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## Abstract

### **”Lasing Without Inversion: Bose-Einstein Condensation of Polaritons in Semiconductor Microcavities”**

There are a number of energy quasiparticles which exist and move freely inside solids— phonons, excitons, plasmons, magnons, etc. Polaritons are another type of quasiparticle, which share many properties with photons but can also have effective mass and scatter from each other like atoms in a gas. In specially designed circumstances they can undergo Bose-Einstein condensation just like atoms in the well-known atomic condensates in optical traps. We have succeeded (Science 316, 1007 (2007)) at trapping polaritons and making condensates which have many of the same properties as atomic condensates. The polariton condensate emits coherent light, and therefore is also like a laser in many ways, but it is fundamentally different in some ways, leading some to call it “lasing without inversion”. I will review the physics of polaritons and discuss the recent work by our group and other groups around the world.

## Biography

David Snoke (A.B. Cornell '83, Ph.D. University of Illinois at Urbana-Champaign '90) is an associate professor of experimental condensed matter physics in the Department of Physics and Astronomy of the University of Pittsburgh. Before coming to Pittsburgh he worked with Manuel Cardona at the Max-Planck Institute for Condensed Matter Research in Stuttgart, Germany. He has long studied exciton and electron dynamics in semiconductors, and was recently named a fellow of the American Physical Society for his contributions in this field.

**THE TECHNOLOGY FORUM PROGRAM IS FREE AND OPEN TO THE PUBLIC.**

*For further information concerning this presentation, please send an email to*

*Maggie Hall at [mahall@state.pa.us](mailto:mahall@state.pa.us)*



# Specks



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SPECTROSCOPY SOCIETY OF PITTSBURGH

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## OCTOBER MEETING

Wednesday, OCTOBER 17, 2007

Technical Program - 8:15 p.m.

DUQUESNE UNIVERSITY

Mellon Hall of Science (Laura Falk Hall)



### Professor Lucy McFadden

University of Maryland

### “NASA’s Dawn Mission: Journey to the Asteroid Frontier”



6:00 p.m. - Social Hour

6:30 p.m. - Dinner (City View Cafe - 6th Floor)

8:00 p.m. - Business Meeting (Maurice Falk Auditorium)

8:15 p.m. - Speaker’s Presentation (Maurice Falk Auditorium)

## Abstract

### “NASA’s Dawn Mission: Journey to the Asteroid Frontier”

NASA’s Dawn mission is designed to travel to asteroid 4 Vesta and dwarf planet Ceres on an eight year journey to the asteroid frontier. Our mission is to understand the origin and evolution of the solar system by obtaining geophysical and geochemical data on these two diverse bodies located in the asteroid belt between Mars and Jupiter. This is a dramatic mission that makes use of new propulsion technology, called ion propulsion that was demonstrated effective in a technology demonstration mission that flew past an asteroid and a comet between 1998 and 2001, called DS 1. The advantage of ion propulsion is that it carries us into the middle of the asteroid belt at a cost of under \$400 million dollars. The down side is that it takes a lot of time, 4-years to get to Vesta, and another three to get to Ceres. The mission plan allows us to orbit both bodies. Dawn is the first NASA mission to orbit two bodies. The spacecraft carries three instruments, imagers, a visible and infrared spectrometer and a gamma-ray (VI R) and neutron spectrometer (G RaN D). The radio antenna provides astrometry from which the gravitational field and internal structure can be inferred. Vesta is a differentiated body that melted and differentiated soon after the solar system formed. A major collision in the Southern Hemisphere of Vesta resulted in hundreds of fragments from 1-50 kilometers being thrown into space. (Vesta’s diameter is 530 km). In the following 4.5 billion years, gravitational interactions within the asteroid belt sent fragments into a resonance in the inner belt and from there they were ejected into earth-crossing orbits. About 7% of all meteorites are likely from Vesta. We look to Vesta for evidence of other planet-like processes to understand how planets were formed in the early solar system. If it weren’t for this large collision, Vesta might also be a dwarf planet. Ceres on the other hand, is larger than Vesta and is 952 km in diameter. It too is differentiated like Vesta, but it contains a lot of water. Why is one body dry and the other wet? What are the differences and similarities between their surface and interior structures and compositions? The spectrometers and cameras on board the Dawn spacecraft will answer those questions.

The mission ends in July 2015. Will our new view of these protoplanets change our view of the solar system and how it formed? Most likely, and in ways that I can’t anticipate now.

## Biography

Dr. Lucy McFadden is a planetary scientist at the University of Maryland’s Department of Astronomy. Her field of expertise is the solar system with a focus on the role of asteroids and comets in the solar system’s formation. She has also created and overseen the execution of education and public outreach programs for NASA’s Deep Impact mission which excavated a crater in comet Tempel 1, and the Dawn mission to orbit Vesta and Ceres.

She received her undergraduate degree from Hampshire College, Amherst, MA, in 1974, an MS from the Massachusetts Institute of Technology, 1977 and a PhD in Geology & Geophysics from University of Hawaii, 1983. She has been a National Science Foundation Visiting Professor and was founding faculty director of the Science, Discovery & the Universe Program of the College Park Scholars at College Park.

In addition to teaching and research she has served on the National Research Council’s Committees on Data Management and Computation (CODMAC), and Planetary and Lunar Exploration (COMPLEX) as well as the editorial board of Icarus, the International Journal of Solar System Research. She is an editor of the Encyclopedia of the Solar System published in second edition by Elsevier/ Academic Press, 2007.

Dr. McFadden has co-authored over 70 research papers in refereed publications. She played a lead role in coordinating the World-wide effort to observe Comet Shoemaker-Levy 9’s collision with Jupiter in 1994. She was a member of the science team for NASA’s Near-Earth Asteroid Rendezvous (NEAR) mission, which orbited asteroid 433 Eros for a year and landed on February 14, 2001. She was a co-Investigator of the Deep Impact mission to Comet Tempel 1, with responsibilities for its education and public outreach program. She is also a co-investigator of NASA’s Dawn mission launching in September, 2007 to orbit asteroids Vesta and Ceres in 2011 and 2015, respectively. Dr. McFadden recently served on the senior review team of the Near Earth Object Survey report which Congress requested of the NASA administrator to submit a plan to survey 90% of potentially hazardous objects 140 meter in diameter and larger by the end of 2020. In July, 2007, NASA announced that the Deep Impact spacecraft was selected to continue to another comet, and the mission EPOXI began. This mission will both travel to another comet, and characterize extra-solar planets around nearby stars.

**Dinner Reservations:**

This month's dinner will be a Tomato Dill soup, salad, Sauerbraten, Potato Pancakes and Fresh Green Beans with Mushrooms. Apple Strudel w/ Vanilla Cream Sauce will be served for dessert.

Please email Carolyn Benga at [crbssp@yahoo.com](mailto:crbssp@yahoo.com) or call (412) 487-0915 to make dinner reservations NO LATER THAN FRIDAY, October 12, 2007. Dinner will cost \$8 and checks can be made out to the SSP. If you have dietary restrictions, please let Carolyn know when you RSVP.

**Parking Instructions:**

The Duquesne University Parking Garage is located on Forbes Avenue. Upon entering the garage, receive parking ticket and drive to upper floors. Pick up a parking chit at the dinner or meeting. If any difficulties arise, contact Dr. Mitch Johnson at Duquesne University.