Department of Physics & Astronomy

PHYSICS NEWS FLASH

Stephen Wilson Wins 2006-2007 GMAG Student Dissertation Award

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Stephen Wilson

Physics graduate student Stephen Wilson has been honored for his efforts to understand the basic principles driving high-temperature superconductivity. The Topical Group on Magnetism and Its Applications (GMAG), a sub group of the American Physical Society, has named him a winner of the 2006-2007 GMAG Student Dissertation Award. The accolade includes a $500 prize and an opportunity to present an invited talk at the APS March meeting in Denver.

Scientists have long known that superconductivity results from the pairing of electrons, which allows electric current to pass through a material with no resistance. Yet a satisfactory explanation of exactly what binds those electron pairs at high temperatures (high-Tc) has yet to be discovered. In his dissertation work, Wilson uses neutron scattering to get a more precise picture of how high-Tc materials are structured and what properties give rise to their superconductivity. Neutrons are an excellent probe because they are highly penetrating and pass easily through the bulk of materials, and they are sensitive to both structure and static/dynamic magnetism in the system.

Wilson studied the cuprate $Pr_{.88}LaCe_{.12}CuO_{4-d}$, a typical superconductor. Cuprates are ceramic compounds containing elements of metal sandwiched between layers of copper and oxygen atoms. They become superconducting when they are "doped" with a carrier; either electrons or holes (vacant electron positions). Wilson used neutrons to probe the behavior of the material's spin—an intrinsic property, the same as charge or mass. While earlier spin studies have shown that magnetism may play a key role in electron pairing in hole-doped materials, little research has been done on the electron-doped superconductors. Using neutron scattering to reveal the spin behavior of the electron-doped $Pr_{.88}LaCe_{.12}CuO_{4-d}$, Wilson found that magnetic resonance seems to be a unifying fundamental feature among the cuprates, regardless of the doping carrier type. Another part of his dissertation involves studying the spin dynamics in the alloy $Sc_{1-x}U_xPd_3$.

Wilson earned a bachelor's degree in physics at UT in 2002 and subsequently enrolled in the physics graduate program. He joined Professor Pengcheng Dai's research group in 2003 and in 2005 he won the department's Paul H. Stelson Fellowship in Physics for Outstanding Beginning Research. He was the lead author on "Resonance in the electron-doped high-transition-temperature superconductor $Pr_{0.88}LaCe_{0.12}CuO_{4-d}$," which appeared in the July 6 issue of *Nature*.