



4th TcSUH STUDENT/POSTDOC SEMINAR

February 11, 2019 (Monday) 5:30 p.m., HSC 102

Vietnamese Sandwiches and soft drinks will be served!!

RSVP required for sandwich: tcsuhstudents@uh.edu

Search for Higher T_c Superconductors via Interface Mechanism and High Pressure

Dr. Liangzi Deng

TcSUH and Department of Physics

Abstract: Since the discovery of superconductivity in 1911, researchers have continued the search for superconductors with higher transition temperatures (T_c). Many strides have been made with the increase of the T_c , as can be seen from the evolution of record T_c over time. We believe a holistic multidisciplinary enlightened empirical approach can be most fruitful. Over the last few years, we discovered nonbulk superconductivity in rare-earth doped CaFe_2As_2 (Ca122) single crystals with an onset T_c of 49 K, which is higher than the T_c of any known compounds formed of the constituent elements at ambient or under high pressures. We successfully induced superconductivity with a T_c of 25 K in the mixed phase region of two non-superconducting phases in undoped Ca122. Our systematical studies in R-doped Ca122 and undoped Ca122 provided the most direct experimental evidence for possible interface superconductivity in single crystals up to date. More recently, our group discovered a universal resurgence of T_c passing the peak predicted by the general T_c -p (doping) and -P (pressure) relation in BSCCO system, which is supported qualitatively by our density functional theory calculations. This offers a paradigm to raise T_c of the layered cuprate high temperature superconductors to a new height.

Bio: Dr. Liangzi Deng is currently Research Associate 2 in Dr. Paul Chu's group in Texas Center for Superconductivity at University of Houston and Department of Physics.

Unusual Rare-Earth Metal Suboxides: Superconductivity in $\text{La}_{26}\text{Ge}_{18}\text{Ag}_6\text{O}_5$ and Condensed Kondo behavior in $\text{Ce}_5\text{Ge}_3\text{O}_x$

Xiaoqing Ma

TcSUH and Department of Chemistry

Abstract: The new rare-earth suboxide, $\text{La}_{26}\text{Ge}_{18}\text{Ag}_6\text{O}_5$, was synthesized at high temperatures in sealed Nb tubes and its structure was determined by single crystal and powder X-ray diffraction. The reduced lanthanum-germanide-silver-oxide features an unprecedented metallic $[\text{La}_{18}\text{O}_5]$ cluster composed of 5 oxygen-centered La_6O octahedra condensed through shared faces, and a complex Ge-Ag network. The $[\text{La}_{18}\text{O}_5]$ cluster features short La-La distances, consistent with strong metal-metal bonds in the cluster. X-ray pure bulk samples of $\text{La}_{26}\text{Ge}_{18}\text{Ag}_6\text{O}_5$ were found to be superconducting, with a T_c of 5.7 K, with high volume fractions. Attempts to synthesize a Ce analog, " $\text{Ce}_{26}\text{Ge}_{18}\text{Ag}_6\text{O}_5$ ", resulted in the formation of $\text{Ce}_5\text{Ge}_3\text{O}$ with the filled- Mn_5Si_3 structure. Further studies on the effect of oxygen interstitial chemistry on Ce_5Ge_3 led to the non-stoichiometric interstitial phase, $\text{Ce}_5\text{Ge}_3\text{O}_x$ ($0 \leq x \leq 1$). Bulk samples of $\text{Ce}_5\text{Ge}_3\text{O}_x$ were synthesized by arc-melting, under controlled dilute-oxygen gas flow. Magnetic properties of $\text{Ce}_5\text{Ge}_3\text{O}_x$ ($x = 0, 0.2, 0.5, 0.8, 1$) were measured. Contrary to previously published results our measurements indicate that the pure binary Ce_5Ge_3 exhibits Curie-Weiss paramagnetism, with a Curie temperature of ~ -16 K. However, upon incorporation of oxygen in $\text{Ce}_5\text{Ge}_3\text{O}_x$ ($x > 0$), a Kondo magnetic behavior at low temperatures (2 K -10 K) is observed. This is consistent with the previously reported behavior of Ce_5Ge_3 . The Kondo effect appears to increase with oxygen content (optimum Kondo behavior is observed with $x = 0.8$), and decrease (and disappear) with increasing magnetic field. Details of our studies on these compounds will be presented.

Bio: Ms. Xiaoqing Ma is currently a Ph.D. student in Dr. Arnold Guloy's group in the Department of Chemistry and Texas Center for Superconductivity at University of Houston.

Persons with disabilities who require accommodations to attend this seminar should call 713-743-8213.