ICQM Seminar

Upper critical fields of p-wave ferromagnetic superconductors

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Abstract

For nearly three decades, there has been a growing interest in candidate *p-wave superconductors. The first of these, UPt3, has three superconducting* phases. Recent magnetothermal experiments have suggested that it might actually be an *f-wave superconductor. More recently, URhGe and UCoGe* were found to be ferromagnetic superconductors at ambient pressure, with *TCurie > Tc, and the same electrons participate in the ferromagnetism and the* superconductivity. The upper critical field *Hc2 of the low-temperature phase* of URhGe fits the predicted temperature *T behavior of the completely broken* symmetry *p-wave polar state (e.g., p_z) for all three crystallographic directions*, and violates the Pauli limit. Subsequently, a high-field reentrant phase was discovered, which violates the Pauli limit by a factor of 20, and appears to be associated with a metamagnetic transition and a Lifshitz point at which a Fermi surface cross section vanishes. Calculations of the angular dependence of the upper critical induction *Bc2 (in the presence of the ferromagnetism) has shown* that a novel double-peak effect might be observable in URhGe. In UCoGe, the two low-field $B_{c2}(T)$ *curves in directions perpendicular to the spontaneous magnetic* moment ***M0 strongly violate the Pauli limit, and suggest that a p-wave*** state of axial symmetry (e.g., *px±ipy) is likely. Preliminary theoretical calculations* predict kinks in the angular dependence of this low-field $B_{c2}(\theta, T)$. *Then,* for higher fields, $B_{c2,\perp c}(T)$ *also violates the Pauli limit by a factor of 20, and has* strange novel behavior. These results are contrasted with those obtained from the layered superconductor Sr_2RuO_4. Finally, a small selection of interesting experimental figures from the author's book, *Layered Superconductors Volume 1 (Oxford University Press, 2012) will be presented.*

About the Speaker

Richard A. Klemm got his bachelor degree from Stanford University in 1969 and his master degree and Ph.D from Harvard University in 1972 and 1974. From 1974 to 1976, he was a postdoctoral fellow in Stanford University. From 1976 to 1981, he was an Assistant Professor in Iowa State University. From 2011 to present, he has been an Associate Professor in University of Central Florida. His interests are layered superconductors, of which the high-temperature superconducting cuprates are the most famous example, nanomagnetism, especially with to the problems associated with magnetic recording and with the quantum states of single molecule magnets, and recently triplet superconductivity.