Condensed Matter Physics Seminar Series

Novel pairing phenomena in multiband superconductors

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Recently, a number of unconventional superconductors have been analyzed in terms of theories predicting "Hund's pair states". These involve pairs in antisymmetric orbital states, which force significant interband pair weight. Conventionally, such states are not energetically favored because they destroy the Cooper log that leads to a bound state for infinitesimal attraction. I will discusss calculations that investigate the stability of such states on the same footing as more usual spin fluctuation pairing, and propose a very simple qualitative picture of when Hund's pairing can be important. Explicit calculations for Sr2RuO4 show that this mechanism of generating superconductivity is almost certainly not favored. In the second part, I will discuss a situation where interband (spin triplet) pair may be essential, in a proposal for the apparent topological ultranodal state observed in tetragonal FeSe,S when the nematic phase disappears. Here I present a new self-consistent theory including ferromagnetic interactions that can account for nonunitary pairing and C4 symmetry breaking in the superconducting state.

Peter Hirschfeld received his Ph.D. in physics from Princeton University in 1985 and held postdoctoral research appointments at the Technical University of Munich and Stanford University/UCSD before joining the faculty at the University of Florida in 1988. He has also served as visiting professor for a semester or more at Karlsruhe Institute of Technology, University of Augsburg, University of Paris-Sud, Stanford University, the University of Frankfurt and Niels Bohr Institute, U. Copehhagen since then. He has supervised 17 Ph.D. students and taught physics at all levels.

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4-330 PAB