

MAR12-2011-000251

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

The Challenge of Unconventional Superconductivity¹

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In the past few decades, several new classes of superconductors have been discovered. Most of these are unconventional in that they do not appear to be related to traditional superconductors where the order parameter is more or less spatially isotropic. As a consequence, it is felt by many (but not all!) that the cause of superconductivity arises from a different source than the electron-ion interactions that are at the heart of conventional superconductivity. But developing a rigorous theory for any of these classes of materials has proven to be a difficult challenge, and will continue to be one of the major problems in physics in the decades to come. This is particularly true in that if history is any guide, even more dramatic discoveries of unconventional superconductors await us in the future.

¹Work supported by the US DOE, Office of Science, under Contract No. DE-AC02-06CH11357 and by the Center for Emergent Superconductivity, an Energy Frontier Research Center funded by the US DOE, Office of Science, under Award No. DE-AC02-98CH10.