

Abstract for an Invited Paper
for the HAW05 Meeting of
The American Physical Society

Phases of Dense Quark Matter and Neutron Star Structure

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We review recent work on the phase structure of dense quark matter. At densities of relevance to compact objects the strange quark mass is not negligible compared to quark chemical potential. We discuss the role of the strange quark mass in determining the phase structure. The color-flavor-locked (CFL) phase, the 2SC (two-color superconducting) phase, gapless phases, and the LOFF phase as well as Bose condensates may all play a role. We discuss how these quark matter phases may affect observable aspects of neutron star evolution and the neutrino signal in core-collapse supernovae. We highlight a recent calculation which includes the six-fermion interactions in the quark-quark channel for the first time.