APR11-2011-000496

Abstract for an Invited Paper
for the APR11 Meeting of
the American Physical Society

Astrophysical Measurement of the Ultradense Matter Equation of State

FERYAL OZEL, University of Arizona

Neutron stars are the densest objects in the universe and may contain hyperon-dominated matter, condensed mesons, or even deconfined or strange quark matter. Because of their low temperatures and high chemical potentials, the physical conditions in their interiors differ greatly from the dense conditions of the early universe or those achieved at hadron colliders. This region of the QCD phase diagram can best be probed through astrophysical observations that measure the masses and radii of neutron stars. I will discuss how we can break degeneracies in the measurements of neutron star properties by combining recent developments in our understanding of their atmospheres with observations of multiple spectroscopic phenomena from X-ray binaries. I will present unique measurements of the masses and radii of a number of neutron stars in low-mass X-ray binaries and show the equations of state of neutron star matter that are compatible with these observations. These measurement constrain, for the first time, the pressure of cold matter above nuclear saturation density and offer tantalizing evidence for new degrees of freedom at ultrahigh densities.