Columbia University
Department of Physics Colloquium

"Have We Converged on an Understanding of the Neutron Star Equation of State?"

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Observations of neutron stars in optical, X-ray and radio radiation are leading to interesting constraints on their internal properties and the equation of state of extremely dense matter. The discovery of a nearly 2 solar mass pulsar restricts the properties of quark matter if it is to exist in any form in neutron stars. Radius limits have been set from X-ray observations of photospheric radius expansion bursters and from quiescent low-mass X-ray binaries in globular clusters. Measurements of surface temperatures from isolated, cooling neutron stars also constrain their internal properties, including superfluidity. Simultaneously, various nuclear experiments and theoretical studies of pure neutron matter have tightly constrained the symmetry properties of matter near the nuclear saturation density. Remarkably, the astrophysical and nuclear constraints are highly compatible, implying for the first time that the most important properties of dense matter are now reasonably known.

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