Notre Dame Science
Department of Physics

COOLING NEUTRON STAR IN CAS A: EVIDENCE FOR SUPERFLUIDITY IN THE CORE

Dr. Dima Yakovlev
Joffe Institute, St. Petersburgh
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According to recent results of Ho and Heinke (2009,2010) the Cassiopeia A supernova remnant contains a young neutron star which has carbon atmosphere and shows noticeable decline of the effective surface temperature. The decline is naturally explained if triplet-state neutron superfluidity appeared recently in the neutron star core, producing a splash of neutrino emission due to Cooper pair formation process that currently accelerates the cooling. This scenario puts stringent constraints on poorly known properties of neutron star cores: on density dependence of the temperature T_{cn}(\rho) for neutron superfluidity onset (should be a wide peak with maximum (about (6-8)\times 10^8 K), on the reduction factor q of Cooper pairing neutrino emission by collective effects in superfluid matter (q> 0.4), and on the neutrino emission before neutron superfluidity onset (30-100 times weaker than the modified Urca). This is serious evidence for nucleon superfluidity in neutron star cores that comes from observations of cooling neutron stars.

[Co-Authors: **Peter Shternin (Ioffe Institute, Russia), Wynn Ho (Univ. Southampton, UK) Craig Heinke (Univ. Alberta, Canada), Dan Patnaude (SAO, USA)]**

Nuclear Seminar

All interested persons are cordially invited to attend.