

Spring 2018 Colloquium

Department of Physics & Astronomy, TAMU-Commerce

Apr 26, Thursday, 4-5 PM in Science Building 127

(coffee and cookies will be served at 3:50 PM)

Astronomy, Astrophysics

What neutron stars are made of?

Dr. Jérôme Margueron

University of Washington USA; UNIVERSITE CLAUDE BERNARD LYON-1, France



Dr. Jérôme Margueron earned BS (1996) and MS (1998) degrees in Physics at ENS Lyon (France) and a Ph.D. degree (2001) in Physics at the University Paris-Sud Orsay (France). His Ph.D. research topic was on neutrino propagation in dense and hot matter encountered in core-collapse supernovae. He worked as a post-doc on various developments on many-body theory for dense matter such as quantum super-symmetry at GANIL (France), reaction mechanisms with halo nuclei at INFN Pisa (Italy), and high-Tc superconductivity at University of Tuebingen (Germany). In 2004, Dr. Jérôme Margueron got his tenure as a researcher of “centre national de la recherche scientifique” (CNRS) France. He worked at IPN Orsay from 2004 to 2013, spent a sabbatical (6 months) in Japan in 2007, and then moved to IPN Lyon in 2013. In 2016, he moved to Institute for Nuclear Theory (INT) at University of Washington for a period of 2 years. His main research topic is nuclear astrophysics and he is interested in the physics of neutron stars, core collapse supernovae and kilonovae (neutron star mergers). More information about Dr. Jérôme Margueron and his research can be found at <https://www.ipnl.in2p3.fr/perso/margueron/official/home.html>, and a recent general public article about kilonovae <https://theconversation.com/piercing-the-mystery-of-the-cosmic-origins-of-gold-88880>

Abstract

Neutrons stars are stellar objects containing about 10^{57} particles in an extremely tiny volume of 10-15 km radius. They have been observed with masses going from 1.2 Mo (solar mass) up to 2 Mo, but the theoretical limits are much wider. Fascinating phenomenons are associated to neutron stars: beamed radio-emission, X and gamma rays emissions, glitches of the rotational frequency, anomalous cooling, thermal relaxation of the crust, etc... All these observations potentially carries information on the properties of dense matter and requires the best underpinning theoretical modeling. Despite recent progress, there are still a lot of unresolved questions related to the physics of neutron stars. Maybe the most important one is the question of their composition, which reflects the properties of nuclear and QCD physics. In this talk, I will illustrate how the unknown in the nuclear equation of state could be formalized in terms of the nuclear empirical parameters. Based on some examples, the relation between uncertainties in these parameters and the ones on the masses and radii of neutrons stars will be exemplified, and the main sources of uncertainties will be discussed. Finally, an analysis of the recent kilonova detection in gravitational waves by the LIGO-Virgo collaboration will be presented and confronted to our present knowledge of nuclear physics.