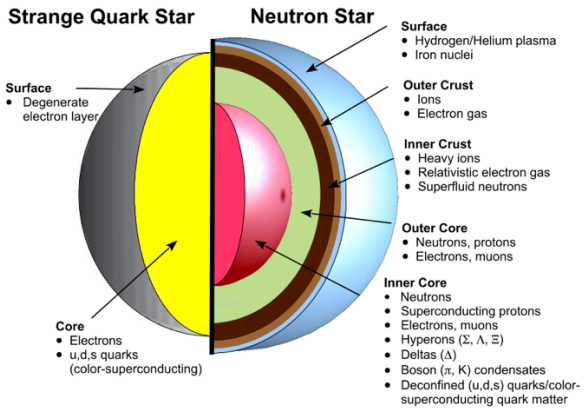
Talk to Café Scientifique Romsey

February 27th 2020
Audience of 109

Neutron stars – Laboratories for fundamental physics.

Dr Andreas Schmitt,
Mathematical Sciences, University of Southampton.
(https://www.southampton.ac.uk/maths/about/staff/as21g15.page)



Ultra-dense matter exists in the interior of neutron stars. These stars have (roughly) the same mass as the sun, but only a radius of about 10 km. The resulting extreme densities correspond to the densities found within large atomic nuclei and may even be several times higher than that in the core of the star. It is even conceivable that the core of a neutron star consists of a fluid of quarks rather than of protons and neutrons. Therefore, the extreme environment of neutron stars is a laboratory for fundamental physics, and astrophysical data can be used to improve our understanding of the interactions between elementary particles.

Relating observables such as mass, radius, temperature, and rotation frequency to microscopic properties of ultra-dense matter is part of an ongoing effort in current research. Recently a new window for observations has opened through the first detection of gravitational waves from a neutron star merger. Combined with the more traditional electromagnetic signals, we expect to use this new window in the near future to improve and deepen our understanding of the fundamental laws of physics.

More information

- Cartoon explaining neutron stars
  https://www.youtube.com/watch?v=ZW3aV7U-aik
- Video about a European collaboration working on neutron stars and ultra-dense matter
  https://www.youtube.com/watch?v=86UpfxwIrGU
- Official website of the LIGO collaboration (gravitational wave detection)
  https://www.ligo.caltech.edu
- NICER mission (current measurements of neutron star radii)
  https://heasarc.gsfc.nasa.gov/docs/nicer/