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Theorie-Palaver

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MITP seminar room

Ben Safdi
Berkeley

Compact stars as axion laboratories

The quantum chromodynamics axion and axion-like particles are some of the most sought-after beyond the Standard Model particles at present because of their possible connections with the strong-CP problem, dark matter, and ultraviolet physics such as Grand Unification and String Theory. Laboratory searches are underway around the world to search for these hypothetical particles, but certain regions of axion parameter space -- such as ultralight axions with weak couplings to matter -- are notoriously difficult to probe with terrestrial experiments, despite their theoretical motivations. However, axions in this part of the parameter space may be produced in abundance within compact stars such as white dwarfs and neutron stars. It has long been recognized that axion production in compact stars opens up a new pathway for them to cool. I will point out, however, that axions may also lead to novel X-ray signatures around these stars, whereby the axions are produced within the stellar cores and then convert to photons in the strong magnetic fields surrounding the stars. I will discuss recent data taken by the XMM-Newton and Chandra telescopes from nearby neutron stars and white dwarfs that provide some of the strongest probes to-date of axions by searching for these processes.

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