GR 14: Relativistic Astrophysics IV

Time: Thursday 16:15–17:00 Location: KH 01.016

GR 14.1 Thu 16:15 KH 01.016

Neutron stars under the influence of dark matter — •Sarah Louisa Pitz and Jürgen Schaffner-Bielich — Max-von-Laue-Str. 1 60438 Frankfurt am Main

Neutron stars represent ideal laboratories to test different kinds of matter under the influence of strong gravity and high magnetic fields. Due to their age and their strong gravitational field neutron stars could capture dark matter particles and thus serve indirectly as dark matter detectors. We include bosonic, self-interacting dark matter with a sufficiently stiff self-interaction potential in the form of $V \propto \phi^n$ and find that these neutron stars become ultra-compact. They are compact enough to have a stable photon orbit at their surface or even above, a property that is otherwise exclusively attributed to black holes or hypothetical boson stars. These ultra-compact neutron stars could be formed by a boson star accreting ordinary matter. We will present results on how a high compactness of the boson star affects the accretion rate and thus the mass of the resulting neutron star.

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GR 14.2 Thu 16:30 KH 01.016

Neutrino production in blazars with extreme Doppler factors — •Aditya Tamar — Max Planck Institute for Radio Astronomy, Bonn, Germany

There have been recent population studies supporting the idea that radio-loud blazars can be the potential source of high-energy astrophysical neutrinos. The understanding of neutrino production from these sources is intimately connected to explaining their multi-wavelength spectra as well. In this talk, ongoing work will be presented in modelling the lepto-hadronic spectral energy distribution (SED) for PKS 1749+096, a neutrino-candidate blazar with strong Doppler boosting. In the proposed framework, both the bulk properties and the particle distribution in the emission region, are anchored directly using parsec-scale very-long-baseline (VLBI) observations of its jet. When combined with physically motivated assumptions about jet stratification, this approach allows modeling the SED from radio to gamma-rays without using model-agnostic numerical fitting to archival data, whilst also using VLBI-driven inferences to probe the location and properties of the neutrino production region in the blazar jet. Thus, the talk attempts to motivate using radio observations as an anchor for improving our understanding of multi-messenger emission from neutrino-candiate blazars.

GR 14.3 Thu 16:45 KH 01.016

Hot Dark Stars: Mass-Radius Curves of an Interacting Fermi Gas at Finite Temperatures and Their Collapse to Black Holes — •Adil-Mir Zia, Ishfaq Ahmad Rather, Selina Kunkel, Sarah Pitz, and Jürgen Schaffner-Bielich — Institute for Theoretical Physics, Goethe University, Frankfurt am Main

We investigate the mass-radius relations of dark stars using a temperature-dependent equation of state for interacting Fermi gases. Varying the entropy per baryon and the interaction strength allows us to quantify how finite-temperature effects and the underlying couplings influence the structure and stability of hot dark stars. We also compute the particle number along constant-entropy sequences to examine the possibility of a delayed collapse during the early evolution. These results clarify how thermal and interaction effects shape the properties of newly formed dark stars.