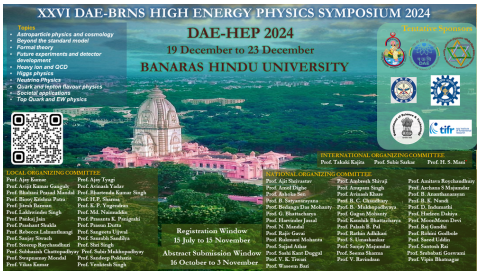

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Effect of Magnetic Fields on Urca Processes in Neutron Star Mergers

Isospin-equilibrating weak processes, called "Urca"processes, are of fundamental importance in astrophysical environments like (proto-)neutron stars, neutron star mergers, and supernovae. In these environments, matter can reach high temperatures of tens of MeVs and be subject to large magnetic fields. We thus investigate Urca rates at different temperatures and field strengths by performing the full temperature and magnetic-field dependent rate integrals for different equations of state. We find that the magnetic fields play an important role at temperatures of a few MeV, especially close to or below the direct Urca threshold, which is softened by the magnetic field. At higher temperatures, the effect of the magnetic fields can be overshadowed by the thermal effects. We observe that the magnetic field more strongly influences the neutron decay rates than the electron capture rates, leading to a shift in chemical equilibrium.

Field of contribution

Theory

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