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Thermoelectric effects in neutron star inner crusts in magnetic fields

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We study the thermal conductivity and thermoelectric power of the inner crust of a neutron star at finite temperatures where ions are in a liquid state. Such crust can be formed in various astrophysical scenarios including binary neutron star mergers, proto-neutron stars and accreting neutron stars. We employed the linearized Boltzmann equation assuming simultaneous presence of electromagnetic fields and gradients of temperature and chemical potential. In the electron-ion collision integral the finite nuclear size, the ion-ion correlations and the Debye screening were taken into account. Numerical results were obtained for five compositions of the inner crust, showing the dependence of the thermal conductivity and thermoelectric power on the mass density, temperature and magnetic field. In addition, the timescales of magnetic field evolution were estimated in order to assess the importance of thermoelectric phenomena in the evolution of crustal magnetic fields.

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