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# Magnetized dense neutron and neutron star matter

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A neutron star is one of the possible end states of a massive star. It is compressed by gravity and stabilized by the nuclear degeneracy pressure. Despite its name, the composition of these objects are not exactly known. However, from the inferred densities, neutrons will most likely compose a significant fraction of the star's interior. While all neutron stars are expected to have a magnetic field, some neutron stars ("magnetars") are much more highly magnetized than others: the inferred magnetar surface magnetic field is between $10^{14}$ to $10^{15}$ gauss.

Neutron stars are the densest stable states of matter that can currently be directly observed. Some neutron stars ("pulsars") emit strongly in the radio part of the electromagnetic spectrum. Observation of this radiation is one of the major observational targets of what will the world's largest radio telescope, the Square Kilometre Array.

While neutron stars are macroscopic objects, due to the extreme value of the stars' energy, pressure, and magnetic field the physics of the microscopic scale can be imprinted on the star's large scale behaviour. Thus the study of these objects are a combination of various fields of physics ranging from Quantum Mechanics to General Relativity. One of the main inputs to any calculation of neutron star properties is the equation of state of the matter that comprises the interior of the star.

This talk will focus on describing the thermodynamics of magnetized dense neutron and neutron star matter, its equation of state, and how the equation of state is applied to study observational consequences in neutron stars.

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