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Magnetic field amplification in proto-neutron stars

Extremely strong magnetic fields of the order of 10^15 Gauss are required to explain the properties of magnetars, the most magnetic neutron stars. Such a strong magnetic field is expected to play an important role for the dynamics of core-collapse supernovae, and in the presence of rapid rotation may power superluminous supernovae and hypernovae associated to long gamma-ray bursts. The origin of these strong magnetic fields remains, however, obscure and most likely requires an amplification over several orders of magnitude in the protoneutron star. I will review our current understanding of the physical processes that may lead to this magnetic field amplification, including the magnetorotational instability and the convective dynamo.

Primary author(s) : Dr GUILET, Jérôme (CEA Saclay, Department of Astrophysics)

Presenter(s) : Dr GUILET, Jérôme (CEA Saclay, Department of Astrophysics)