Poster Session #C
Gravity theories

C11

Axisymmetric equilibrium models for magnetised neutron stars in scalar-tensor theories

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Among the most promising "alternative theories of gravity", one of the most studied class is that of "scalar-tensor theories of gravity" (STTs), because they are the most simple extensions of general relativity (GR), they don't lead to pathologies in the spacetime properties, and show behaviours that look promising in the context of cosmological constraints. Some of these theories predict a phenomenon known as "spontaneous scalarisation", which produces strong deviations from GR in compact objects, like neutron stars (NSs), while fulfilling the strong observational constraints in the weak gravity regime. Such phenomenon is potentially observable in this new era of gravitational wave astronomy. We present here, for the first time, the results of numerical multi-dimensional modelling of NSs in STTs, with the inclusion of magnetic fields, accomplished by the simultaneous solution of the coupled scalar-Einstein-Maxwell equations. We show how global quantities, like mass, inertia moments and magnetic deformation, which are potentially observable, deviate from GR. We show that it is possible to provide a simple parametrisation of the magnetic deformation and of the power emitted in scalar and tensor gravitational waves by NSs in terms of just their baryonic mass, circumferential radius and scalar charge. We demonstrate that a universal scaling exists between these quantities and the magnetic deformation, independently of the magnetic field geometry, of the parameters of the STT and of the (realistic) equation of state, potentially providing new tools to both test STTs and probe the equation of state of NSs, with the hope of disentangling the known degeneracy between their effects.