Modelling binary neutron star magnetospheres

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Résumé

The first detection of a neutron star binary merger through both gravitational waves and electro- magnetic signals revived interest in the coalescence of compact objects. While post-merger signals are rather well understood, models also suggest electromagnetic emissions prior to coalescence, but their properties remain unknown and no detection of them has been reported so far. We aim to characterize these precursory electromagnetic emissions and model the physical processes leading to it. In this work, we investigate the rearrangement of an axisymmetric pulsar's magnetosphere interacting with a rotating perfect conductor. To do so, we resort to a numerical approach that has never been used for this purpose, called Particle-in-cell. This method has the advantage of simulating both the magnetosphere's global dynamics and the microphysical processes responsible for particle acceleration and radiation. We show that the distance between the two bodies and the rotational regime of the orbiting conductor are determinant parameters regarding the magnetospheric features. We find a substantial increase of emitted Poynting flux and particles production, compared to an isolated pulsar's environment. This supports the assumption that electromagnetic counterparts can be emitted from binaries, prior to the coalescence phase.

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