Abstract

$\alpha\Omega$ dynamo driven by the magnetorotational instability in binary neutron star mergers.

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The observation of GW170817/GRB 170817A confirmed that the origin of short gamma-ray bursts (GRBs) is binary neutron star (BNS) mergers. The presence of strong large-scale magnetic fields in the case of a long-lived remnant can lead to the production of a relativistic jet, which can be observed as short gamma-ray bursts. However, the mechanism to generate large-scale magnetic fields in the remnant remains unclear. Previous studies showed that the magnetorotational instability (MRI) can generate a large-scale field in proto-neutron stars and is therefore a promising mechanism for binary neutron mergers.

I will present our group's general-relativistic neutrino-radiation magnetohydrodynamic simulation of a hundred millisecond-long BNS merger. We consider a symmetric BNS merger with masses of 1.35 and $1.35M_\odot$ and we find a strong MRI turbulence as well as a globally coherent axisymmetric magnetic field in the long-lived remnant. This large scale magnetic field shows an oscillating behaviour, that can be described as a mean-field $\alpha\Omega$ dynamo with a period of ~ 20 ms. I will show how the generated magnetic field may impact the jet, which is launched after ~ 40 ms and have properties comparable to short GRB jets.

Overall, our results supports the formation of short-hard gamma-ray bursts in the long-lived remnant scenario.