Jerome Guilet:

Modelling extreme stellar explosions in the millisecond magnetar scenario

The birth of a neutron star with an extremely strong magnetic field and a very fast rotation, called a millisecond magnetar, is a promising scenario to power a variety of outstanding explosive events. This includes gamma-ray bursts, hypernovae and super-luminous supernovae. One of the main uncertainties in the modelling of these explosions is the origin and the properties of the magnetic field. I will describe recent advances in modelling dynamo action in a protoneutron star from the two mechanisms generally considered: the magnetorotational instability and the convective dynamo. 3D numerical simulations show that a magnetar-strength magnetic field can be generated by these two mechanisms if the progenitor core rotates sufficiently fast. These simulations also show that the field geometry is much more complex than generally assumed in simulations of magnetorotational explosions. I will describe first attempts to estimate the consequences of this complexity on the explosion and discuss future perspectives.