General Relativistic MagnetoHydroDynamic Simulations: a Review and Status Report

B. Giacomazzo

1 University of Trento, Trento, Italy
2 INFN-TIFPA, Trento, Italy

In this talk I will review the current state of the art of general relativistic magnetohydrodynamic (GRMHD) simulations in the field of relativistic astrophysics. Main applications of such simulations are in the study of accretion disks and compact binary mergers [1,2]. The latter has seen in particular an increase in the number of groups and codes performing such simulations. After the first GRMHD simulations of binary neutron star mergers almost 10 years ago [3–5], an increasing number of results, including also mergers of neutron star - black hole binaries and binary black hole systems, have been published with an increasing level of numerical accuracy. Simulations include the use of different schemes for the evolution of magnetic fields and the use of very high resolutions that are starting to also shed light on the role of turbulence in the dynamics of these systems. All these studies are also motivated by the need to search for electromagnetic counterparts of gravitational waves (GWs), especially now that GWs are being detected on almost a regular base [6,7]. Another strong motivation is related to the study of the central engine of short gamma-ray bursts [8] and to the possibility for binary systems to launch relativistic jets [9,10]. In this talk I will also describe some of the limits of current GRMHD simulations, especially when comparing them with special relativistic ones, where more advanced algorithms are currently employed.