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Neutrinos and gravitational waves from magnetized neutrino-dominated accretion discs with magnetic coupling

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Gamma-ray bursts (GRBs) might be powered by black hole (BH) hyperaccretion systems via the Blandford-Znajek (BZ) mechanism or neutrino annihilation from neutrino-dominated accretion flows (NDAFs). Magnetic coupling (MC) between the inner disc and BH can transfer angular momentum and energy from the fast-rotating BH to the disc. The neutrino luminosity and neutrino annihilation luminosity are both efficiently enhanced by the MC process. In this paper, we study the structure, luminosity, MeV neutrinos, and gravitational waves (GWs) of magnetized NDAFs (MNDAFs) under the assumption that both the BZ and MC mechanisms are present. The results indict that the BZ mechanism will compete with the neutrino annihilation luminosity to trigger jets under the different partitions of the two magnetic mechanisms. The typical neutrino luminosity and annihilation luminosity of MNDAFs are definitely higher than those of NDAFs. The typical peak energy of neutrino spectra of MNDAFs is higher than that of NDAFs, but similar to those of core-collapse supernovae. Moreover, if the MC process is dominant, then the GWs originating from the anisotropic neutrino emission will be stronger particularly for discs with high accretion rates.

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