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Studying Post-merger Outflows from Magnetized Neutrino-cooled Accretion Disk Simulations

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Neutrino-cooled accretion flow around a spinning black hole, produced by a compact binary merger is a promising scenario for jet formation and launching magnetically and neutrino-driven outflows. Based on GW170817 gravitational wave detection by LIGO and Virgo observatories followed by electromagnetic counterparts, this model can explain the central engine of the short duration gamma ray bursts (GRB) and kilonova radiations. Using the open-source GRMHD HARM_COOL code, we evolved several 2D magnetized accretion disk-black hole models with realistic equation of state in the fixed curved space-time background. The disk and black hole's initial parameters are chosen in a way to represent different possible post-merger scenarios of the merging compact objects. Our simulations show a strong correlation between black hole's spin and ejected mass. Generally, mergers producing massive disks and rapidly spinning black holes launch more wind outflows. We applied particle tracer technique to measure the properties of the outflows, and Skynet r-process nucleosynthesis code to measure the abundances for the ejected matter. We observed our models generate winds with moderate velocity (v/c ~ 0.1-2.0), and broad range of electron fraction. We use these results to estimate the luminosity and light curves of possible radioactively powered transients emitted by such systems. We found the luminosity peaks within the range of 10^40-10^41 erg/s which agrees with previous studies for disk wind outflows.

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