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Neutron star accretion events in AGN discs: mutimessenger implications

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We investigates the accretion of neutron stars (NSs) in active galactic nucleus (AGN) accretion discs. We classify potential accretion modes of NSs in AGN discs, proposing a hierarchical model of NS accretion: accretion flow from the Bondi sphere to accretion columns. The accretion of NSs in AGN discs differs from that of BHs, especially within the scale of the NS's magnetosphere due to its hard surface and magnetic field. As the accretion flow approaches the magnetosphere, the magnetic fields guide the accretion flow to form accretion columns, primarily dominated by neutrinos. While neutrinos generated from single NS accretion may not have observable effects, considering the all-sky background, they contribute to the neutrino background in the sub-MeV energy range comparable to that of supernova explosions. NS accretion may also lead to the generation of mass quadrupole moments, consequently generating gravitational waves (GWs). The GWs, which exhibit characteristic effects like periodic modulations and echoes, could be observed by third-generation GW detectors. The emission of neutrinos and GWs carries away energy and angular momentum brought by accretion, reducing the feedback effect on the AGN disc. This results in an exceptionally high NS accretion rate, leading to a collapse time-scale shorter than the migration-merge time-scale, making it less likely that binary NS mergers originate from AGN discs.

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