

W22a Merging binary black holes with misaligned spins from primordial binaries

Trani, A. Alessandro (The University of Tokyo); Tanikawa, Ataru (The University of Tokyo), Fujii, Michiko (The University of Tokyo), Kumamoto, Jun (The University of Tokyo)

The recently published gravitational wave catalog (GWTC-2) shows a nonzero fraction of binary black hole (BBH) systems with component spins misaligned with the orbital angular momentum. The data even suggests that some BBH are tilted by more than 90 degrees with respect to their orbital angular momentum, giving rise to a negative effective inspiral spin parameter. It is difficult to reconcile this fact with currently proposed formation pathways: BBH from isolated primordial binaries will have spins aligned with the binary angular momentum, due to tidal spin-up. On the other hand, isolated black holes are thought to be born with low spins. To reconcile the observations, we propose an alternative formation pathway that combines isolated binary evolution and dynamical interactions in stellar clusters. In our scenario, BBHs from primordial binaries in stellar clusters undergo three-body encounters, which will tilt the binary orientation and result in misaligned spins. We compare the distributions of effective spin parameters from our model with the current Ligo-Virgo observations and provide the expected merger rates.