中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Contribution ID: **61** Type: **Either**

Stellar Mass Black Hole Formation from Magnetized Core-collapse Supernova Simulations

Core-collapse supernovae (CCSNe) are the birthplace of neutron stars and stellar-mass black holes (smBH), albeit the exact explosion engine(s) remain elusive. Observationally, magnetized CCSNe have been linked to long gamma-ray bursts and magnetars. In this project, we investigate the magneto-hydrodynamics and rotational effects on core-collapse supernova dynamics and multimessenger signals for a 40 solar mass progenitors via two-dimensional self-consistent CCSN simulations with neutrino transport. Our simulation results reveal four distinct morphologies: failed supernovae with smBH formation, neutrino-driven explosions, monopolar jet-driven explosions, and bipolar jet-driven explosions. We find that rotation can significantly delay black hole formation in failed CCSNe, while magnetic fields can aid in their successful revival. In addition, gravitational wave signals show that magnetized neutrino-driven models resemble pure hydrodynamic models, whereas jet-driven models exhibit stronger protoneutron star oscillations.

Section

High Energy

Primary authors: PAN, Kuo-Chuan (Institute of Astronomy, National Tsing Hua University); LI, Yi-Fang (NTHU)

Presenter: LI, Yi-Fang (NTHU)

Session Classification: Poster-HE