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Mergers of compact objects concordant with gravitational-wave events

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Recently several gravitational wave detections have shown evidence for compact object mergers. Three of gravitational waves are sourced by a black hole (BH)-BH mergers more massive than 30 solar mass and one is by neutron star (NS)-NS mergers. It is challenging to explain a high rate of such massive BH mergers, whose progenitors would be very metal-poor stars. Further, existing astrophysical models for neutron star mergers typically predict a lower merger rate than the observed rate. Hence the astrophysical origin of merging binaries is not well understood. One of the most plausible environments for massive BH mergers is galactic nuclei. Since galactic nucleus has a very dense stellar component, frequent two and three body interaction and resonant relaxation of the stellar component work for formation and evolution of binaries. Further, inactive phase, dense gas also plays a role in the formation and evolution. We found binary hardening in active galactic nuclei is faster than binary disruption when gas effects are considered. Then the merger rate in the galactic nucleus is increased significantly. We also have proposed a new channel for mergers of compact objects. We focus on the environments that stellar envelope expands due to a weak failed supernova explosion, neutrino mass loss, core disturbance or envelope instability. In such situations binaries are hardened by ambient gas as shown by density map in Image. Because of a low kick velocity and mergers from large separations, this pathway can be a major pathway for NS-NS mergers. In this talk, I introduce major pathways for compact object mergers and discuss observational differences between each model.

Biography

Hiromichi Tagawa has his expertise in astrophysics. He has completed his PhD at the age of 27 years from Tokyo University. He is a postdoc researcher of GalNUC project in Eotvos University. He is an expert in black hole physics, hydrodynamics and galactic dynamics. His research methods are mainly numerical simulations such as Post-Newtonian simulation, N-body simulation and smoothed particle hydrodynamical simulation.

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