Contribution ID: **264** Type: **Talk in the parallel session**

Importance of Convective Overshoot for GW190521 formation from Population III binary stars

Thursday 8 July 2021 16:30 (20 minutes)

We studied the formation of GW190521-like binary black holes (BHs) from Population (Pop) III binary stars by binary population synthesis technique. We adopted two kinds of Pop III star evolution models with different convective overshoot parameters, both of which can reproduce solar-metallicity star evolution if we change only metallicity from zero metallicity to the solar metallcity. We found that the Pop III star evolution model with the smaller convective overshoot can form GW190521-like merging binary BHs, although the other model cannot. In the first model, the merger rate is 0.04 per year per cubic Gpc at redshift of 0.82, comparable to the merger rate of GW190521-like events infered by gravitational wave observations. In the first model, a star with the initial mass of 90 solar masses can leave behind a BH with 90 solar masses, even if it is a member of a binary star. The star keeps a small radius until its collapse to a BH, and thus its hydrogen envelope is not stripped by its companion star. Moreover, its helium core is less than 40 solar masses, and it can avoid pair instability. We also found that Pop III binary stars in the first model cannot form merging BHs with 100-130 solar masses. If future observations discover a BH mass gap in 100-130 solar masses, Pop III binary stars should be a promising progenitor of GW190521.

Author: TANIKAWA, Ataru (The University of Tokyo)

Co-authors: Dr KINUGAWA, Tomoya; Dr YOSHIDA, Takashi; Mr HIJIKAWA, Kotaro; Prof. UMEDA, Hideyuki

Presenter: TANIKAWA, Ataru (The University of Tokyo)

Session Classification: Exploring the Black Hole Mass Gap

Track Classification: Black Holes: Theory and Observations/Experiments: Exploring the Black Hole Mass Gap