Contribution ID: **12** Type: **not specified**

A Study of Primordial Very Massive Star Evolution

Monday 15 May 2023 17:00 (30 minutes)

We present new evolutionary models of primordial very massive stars, with initial masses ranging from 100 Msun to 1000 Msun, that extend from the main sequence until the onset of dynamical instability caused by the creation of electron-positron pairs during core C, Ne, or O burning, depending on the star's mass and metallicity.
Mass loss accounts for radiation-driven winds as well as pulsation-driven mass-loss on the main sequence and during the red supergiant phase. After examining the evolutionary properties, we focus on the final outcome of the models and associated compact remnants. Stars that avoid the pair-instability supernova channel, should produce black holes with masses ranging from ~40 Msun to ~1000 Msun. In particular, stars with initial masses of about 100 Msun could leave black holes of ~85-90 Msun, values consistent with the estimated primary black hole mass of the GW190521 merger event. Overall, these results may contribute to explain future data from next-generation gravitational-wave detectors, such as the Einstein Telescope and Cosmic Explorer, which will have access to as-yet unexplored BH mass range of ~10^2-10^4 Msun in the early universe.
Finally, some open questions about the evolution of primordial stars will be raised.

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Session Classification: Day 1 afternoon