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Dark Black Holes in the Mass Gap

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According to our current models of stellar collapse, stars in the mass range $\sim 64\text{-}135 M_{\odot}$ undergo pair-instability supernovae, leaving behind no remnant. However, in 2019 LIGO and Virgo detected a black hole merger event with a high probability that the mass of the heavier black hole was within this pair-instability mass gap, motivating the exploration of novel black hole formation mechanisms. We hypothesize that clumps of gas in an atomic dark sector could cool efficiently enough to form a black hole within the mass gap. As a first step, we investigate this scenario with Standard Model parameters by simulating a star without nuclear reactions using the MESA stellar evolution code. Generalizing this investigation to the dark QED sector, we expand the parameter space using a combination of analytical and numerical methods.

Summary

Primary authors: SANTOS-OLMSTED, Lillian (University of California, Santa Cruz); FERNANDEZ, Nicolas (University of Illinois at Urbana–Champaign); GHALSASI, Akshay (University of Washington); PATEL, Hiren (University of California, Santa Cruz); PROFUMO, Stefano; SMYTH, Nolan (University of California, Santa Cruz)

Presenter: SANTOS-OLMSTED, Lillian (University of California, Santa Cruz)

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