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Cecilia Payne-Gaposchkin Doctoral Dissertation Award in Astrophysics Finalist (2021): LIGO-Virgo's Biggest Black Holes and the Mass Gap

MAYA FISHBACH[1], Northwestern University

Models for black hole formation from stellar evolution robustly predict the existence of a pair-instability supernova mass gap in the range ~ 50–$120\,M_\odot$. The binary black holes of LIGO-Virgo's first two observing runs supported this prediction, showing evidence for a dearth of component black hole masses above $45\,M_\odot$. Meanwhile, among the 30+ new observations from the third observing run, there are several black holes that appear to sit above the $45\,M_\odot$ limit. I will discuss how these unexpectedly massive black holes fit into our understanding of the binary black hole population. The data are consistent with several scenarios, including a mass distribution that evolves with redshift and the possibility that the most massive binary black hole, GW190521, straddles the mass gap, containing an intermediate-mass black hole with mass above $120\,M_\odot$.

[1]NASA Hubble Fellowship Program Einstein Postdoctoral Fellow