Poster Session #E
Astrophysics and Gravitational Waves

E07

The Emergence of Structure in the Binary Black Hole Mass Distribution

Vaibhav Tiwari (Cardiff University)

I report an emerging structure in the binary black-hole mass distribution. We use the mixture model framework VAMANA on the observations in LIGO and Virgo's catalog GWTC-2 to reconstruct the underlying mass and spin distributions of the population of merging black holes. Our analysis identifies a structure in the chirp mass distribution, specifically, we identify peaks in the chirp mass distribution at 7.1, 13.5, 25.3, and 45.3 M, and a complementary structure in the component mass distribution. Intriguingly, the location of subsequent peaks are separated by a factor of around two and there is a lack of mergers with chirp masses of 10-12 M. We argue in favour of the hierarchical merger scenario as the source of the observed structure. In simplest terms, these features can be explained when at least one of the black hole binary formation channels suffers a mass-gap near 13 M causing black-holes to pile-up at the first peak combined with the scenario in which lower mass black-holes hierarchically merge to produce higher mass black-holes. The results are limited by statistics but if confirmed by future observation the observed structure in the mass spectrum has far-reaching implications.