Contribution ID: **47** Type: **E-Poster Presentation**

Can Transients Comprising Stellar Population in Galaxy Clusters Constrain Fraction of PBHs in Dark Matter?

Sunday 25 June 2023 17:25 (2 minutes)

Primordial Black Holes (PBHs), proposed to be formed during gravitational collapses of matter in the very beginning of the universe, are one of the many candidates that have been proposed to be a constituent of Dark Matter (DM). They are especially interesting in the fact that they do not need to invoke an unknown particle, and therefore new physics. Postulated to span a wide range of masses ($10^{17} - 10^{23} g$ and $10 - 10^{2} M_{\odot}$), various efforts have been proposed (or carried out) to place limits on the abundance and mass of PBHs. For example, monitoring of lightcurves of extragalactic transients featuring single stars being microlensed is expected to be capable of constraining the fraction of $30 M_{\odot}$ PBHs down to less than 10\% of the total DM fraction.
Here, we consider for the first time constraints imposed on PBHs by transients featuring persistent sources seen towards galaxy clusters. Assuming that these transients are induced by stellar (and PBH) microlensing of star-forming regions in a background galaxy that is themselves lensed by the galaxy cluster, we investigate how the total fluxes can vary over observations according to our simulations. In particular, we select a PBH mass of $30 M_{\odot}$ as a showcase where we demonstrate that under low magnification and low stellar surface mass density, considering 1.5\% of the total DM mass as PBHs will increase the flux variability of such stellar populations and therefore the probability of observing a detectable transient event appreciably. Given the fact that we have an ample amount of such kind of persistent stellar populations in galaxy clusters (for example, the Dragon Arc in Abell 370), we suggest that with long-term monitoring of their flux variability, one can compare the detection rate with the estimated transient detection rate using our methodology of simulation as an alternate method in constraining the abundance of PBHs in DM. With the current data from the Flashlights survey, we are able to constrain the fraction of PBHs in DM down to $< 5\%$ as a first-order approximation. With more observational data coming in the future, it is expected we can put tighter constraints on the $\simeq 30 M_{\odot}$ PBH abundance in DM.

Primary author: Mr LI, Sung Kei (The University of Hong Kong)

Co-authors: Mr ALFRED, Amruth (The University of Hong Kong); Dr LIM, Jeremy (The University of Hong Kong); Dr DIEGO, Jose Maria (IFCA, Instituto de F ısica de Cantabria (UC-CSIC)); Prof. KELLY, Patrick (University of Minnesota Twin Cities)

Presenter: Mr LI, Sung Kei (The University of Hong Kong)

Session Classification: Flash Talks