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Primordial black hole dark matter abundance constraints using lensing parallax of GRBs

Primordial black holes, which could have formed during the early Universe through overdensities in primordial density fluctuations during inflation, are potential candidates for dark matter. We explore the use of lensing parallax of Gamma ray bursts, which results in different fluxes being observed from two different vantage points, in order to probe the abundance of primordial black holes in the unexplored window within the mass range $[10^{-15} - 10^{-11}]M_{\odot}$. We derive the optical depth for the detectability of lensing of GRBs with a distribution of source properties and realistic detector sensitivities. We comment on the ability of the proposed Indian twin satellite mission Daksha in its low earth orbit to conduct this experiment. If the two Daksha satellites observe 10000 GRBs simultaneously and the entirety of dark matter is made up of $[10^{-15} - 10^{-12}]M_{\odot}$ black holes, Daksha will detect non-zero lensing events with a probability ranging from [80, 50] per cent. Non-detections will not conclusively rule out primordial black holes as dark matter in this mass range. However, we show that meaningful constraints can be obtained in such a case if the two satellites are separated by at least the Earth-Moon distance.

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