

Anand Hedge: Gravitational Thomas Precession: New Window to Study PBHs

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Thomas Precession effect is purely a relativistic effect which has been studied extensively in the premises of Special Relativity. From a relativist's perspective, it is due to the non-commutative nature of Lorentz groups. Thomas Precession in the context of general relativity can be realized as a Fermi-Walker transport equation. In this paper, we study Thomas Precession of spin vector upon a passage of gravitational waves. We observe that, the gravitational waves produce Gravitational Thomas Precession when they pass through the system characterized by spin. Conventionally the consequence of Thomas Precession in special relativistic regime can be observed in the fine structure of Hydrogen. We find out that, in the case of a simplified toy model of binary mergers, the fine structure energy levels of hydrogen to be shifted. This is a unique signature of the source and encoded like a memory in the atomic spectra. We further propose this effect can be observed in events involving Primordial Black Holes (PBHs) of mass as light as $O(10^{-13})M$. In this paper we examine the signatures of distribution of primordial blackholes using aforementioned gravitational Thomas Precession. Further we propose the idea of mapping the background in terms of this new Gravitational Thomas Precession effect and thereby, use it to probe and put constraint on mass spectrum.