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Hot Spots, Gamma Rays and Dark Matter

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PBHs in the so called “asteroid mass” range may still constitute all of the relic DM. The low mass end of this range is constrained by the non-observation of extra-galactic gamma rays. If asteroid mass PBHs form hot spots, one should expect firstly some attenuation of the primary gamma ray signal by the hot spot, and secondly a secondary component from the hot spot. Re-examining these constraints including the effect of the hot-spot may shed more light on the asteroid mass gap.

The formation and evolution of these hot spots has been studied during the PBH lifetime but there exist no studies on the fate of hot spots after evaporation ceases. At the moment the evaporation of the PBH becomes too weak to sustain the hot spot (either due to the loss of mass or memory burden) it will begin to cool. However the dynamics of this cooling are unclear and DM in the cooling hot spots may never fully thermalise with the rest of the universe. Indeed, analytical estimates suggest that the cooling of the hot spot may be slower than the cooling of the background universe, suggesting an ever expanding hot spot. The implications of remnant hot spots on structure formation, BBN and the CMB are currently unstudied, and potentially very interesting.

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