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The 511 keV Excess and Primordial Black Holes in our Solar System

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An excess of 511 keV photons has been detected from the central region of the Milky Way. It has been suggested that the positrons responsible for this signal might be produced through the Hawking evaporation of primordial black holes. After evaluating the constraints from INTEGRAL, COMPTEL, and Voyager 1, we find that black holes in mass range of ~ (1 – 4) × 10^16 g could potentially produce this signal if they make up a small fraction of the total dark matter density. If primordial black holes are responsible for the observed 511 keV signal, then we should expect several hundred black holes to reside within the Solar System. This class of scenarios should be testable with proposed MeV-scale gamma-ray telescopes such as AMIGO or e-ASTROGAM.

Summary

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