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Antinuclei from Primordial Black Holes

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Light primordial black holes (PBHs) may have originated in the early Universe, and could contribute to the dark matter in the Universe.
Their Hawking evaporation into particles could eventually lead to the production of antinuclei, which propagate and arrive at Earth as cosmic rays with a flux peaked at GeV energies.
In 2505.04692 we revisit the antiproton and antideuteron signatures from PBH evaporation, relying on a log-normal PBH mass distribution, state-of-the-art propagation models, and an improved coalescence model for fusion into antideuterons.
Our predictions are then compared with AMS-02 data on the antiproton flux.
We find that the AMS-02 antiproton data severely constrain the Galactic PBH density, setting bounds that depend significantly on the parameters of the
lognormal mass distribution, and that are comparable to or slightly stronger than bounds set from diverse messengers.
We also discuss prospects for future detection of antideuterons. Given the bounds from AMS-02 antiproton data, we predict that if antideuterons were to be measured by AMS-02 or GAPS, since the secondary contribution is subdominant, they would clearly be a signal of new physics, only part of which could, however, be explained by PBH evaporation.

Abstract

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