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Where do AMS-02 anti-helium events come from?

Wednesday, March 27, 2019 5:05 PM (30 minutes)

In this talk, I will discuss consequences of the potential detection of anti-helium-3 and -4 events by AMS-02 and in particular the very surprising isotopic ratio in cosmic rays that it would indicate. After showing that spallation from primary hydrogen and helium nuclei onto the ISM cannot account for the measured fluxes, I will argue that dark matter annihilation or decay face similar difficulties in explaining these events. I will then entertain the possibility that these events originate from anti-matter-dominated regions in the form of anti-clouds or anti-stars. Starting with the case of anti-clouds, I will show how the isotopic ratio of anti-helium nuclei might suggest that BBN has happened in an inhomogeneous manner, resulting in anti-regions with a anti-baryon-to-photon ratio $\eta\text{-bar} \propto 0.001\eta$. However, I will show that a variety of observations strongly constrain this scenario, and in particular, would require the anti-clouds to be almost free of normal matter. I will finally discuss an alternative scenario where anti-domains are dominated by surviving anti-stars and suggest that part of the unidentified sources in the 3FGL catalog can originate from anti-clouds or anti-stars.

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