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CR antinuclei predictions and their detectability in the next years

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The creation of anti-nuclei in the Galaxy has been discussed as a possible signal of exotic production mechanisms such as primordial black hole evaporation or dark matter decay/annihilation, in addition to the conventional production from cosmic-ray (CR) interactions. Tentative observations of CR antihelium by the AMS-02 collaboration have re-energized the quest to use antinuclei to search for physics beyond the standard model.

In this talk, we show state-of-art predictions of the antinuclei spectrum from both astrophysical and standard dark matter annihilation models obtained from combined fits to high-precision antiproton data as well as CR nuclei measurements (specially B, Be, Li). Astrophysical sources are capable of producing $\mathcal{O}(1)$ antideuteron event and $\mathcal{O}(0.1)$ antihelium events over 15 years of AMS-02 observations. Standard dark matter models could potentially produce $\mathcal{O}(1)$ antihelium event, while the production of a larger antihelium flux would require more novel dark matter model building. We also discuss that annihilation/decay of a QCD-like dark sector could potentially explain the AMS-02 preliminary observations of antihelium-3 and antihelium-4.

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