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Experimental overview of light-nuclei production in high energy collisions

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Light (anti-)nuclei and hypernuclei are loosely bound objects whose production in high-energy collisions provides a unique window into the late-stage dynamics of the system. Their formation is typically described either through coalescence of nucleons at kinetic freeze-out or via thermal production at chemical freeze-out, and comparisons between these scenarios remain a subject of active investigation. Key observables include transverse-momentum spectra, integrated yields, compound light nuclei ratios (e.g., \(d/p\), \(t/p\), \({}^3\mathrm{He}/p\)), coalescence parameters (\(B_2\), \(B_3\)), and collective flow coefficients measured across a wide range of collision energies and systems. Recent precision measurements by the STAR and ALICE collaborations across RHIC Beam Energy Scan II and LHC Run 2/3 provide critical data to test these models, with implications for QCD phase structure and the role of baryon density.

In this talk, I will present a comprehensive overview of the experimental status of light-nuclei production, focusing on recent results from STAR and ALICE collaborations. I will summarize the measured observables, discuss their systematic behavior with energy, centrality, and multiplicity, and compare the data to expectations from various theoretical frameworks. These studies help constrain hadronization mechanisms and freeze-out conditions while also providing benchmarks for transport and statistical models across a wide energy range.

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