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3-Dimensional WIMP Effective Velocity Distribution

Tuesday 26 August 2025 15:00 (20 minutes)

In the last (more than) three decades, more than 40 experiments have been built or are being planned to search for different WIMP candidates by direct detection of their (elastic) scattering signals off target nuclei in low-background underground laboratory detectors. For an estimate of the scattering event rate as well as for expected determinations of WIMP properties in the future, the velocity distribution of the WIMPs impinging on the detectors plays a crucial roll. In this talk, I will introduce a 3-dimensional WIMP "effective" velocity distribution, which, instead of the theoretically predicted velocity distribution of the "entire" Galactic Dark Matter particles, describes the "actual" velocity distribution of WIMPs "scattering off" (specified) target nuclei in an underground detector. Theoretical arguments will be discussed in detail first. Then numerical results based on our double Monte Carlo scattering-by-scattering simulation of 3-Dimensional elastic WIMP-nucleus scattering events will also be demonstrated. If there is enough time, I will also discuss and demonstrate an interesting (asymmetric) "forward-backward asymmetry" of the 3-D WIMP Galactic effective velocity distribution in both theoretical and numerical points of view.

Collaboration you are representing

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