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Directional recoil rate for direct detection of WIMPs MOQBIL ALENAZI, PAOLO GONDOLO, Department of Physics, University of Utah, 115 S 1400 E Rm 201, Salt Lake City, Utah 84112-0830 — The problem of directional direct detection of weakly interacting massive particles (WIMPs) dark matter (DM) is investigated. We compute, analytically and numerically, the directional differential recoil rate $\frac{dR}{d\cos\theta}$ of recoiled target nuclei hit by WIMPs in direct detection experiments in terms of the angle θ, which is the angle between the reference direction and the recoil direction. While the analytic method is for fixed reference direction and Gaussian distribution of WIMPs, the numeric method is a general method. The two methods give the same results. We apply the numeric method to various Maxwellian distributions including; a stream of WIMPs, the standard dark halo, streams of WIMPs from Sikivie's late-infall (SLI) halo model, and streams with anisotropic velocity distributions. We show the results as distributions of the nuclei's directional differential recoil rate $\frac{dR}{d\cos\theta}$ as a function of $\cos\theta$. We introduce a 'folded' directional differential recoil rate $\frac{dR}{d|\cos\theta|}$ to overcome the difficulty of head-tail discrimination in some WIMP's direct detectors. We conclude that $\frac{dR}{d|\cos\theta|}$ can be helpful in recognizing cases of anisotropic streams and isotropic standard dark halo but not in the case of SLI streams.

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