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WimPyDD: a modular and customizable Python code for the calculation of WIMP-nucleon scattering direct detection signals in virtually any scenario

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We introduce WimPyDD, a modular, object–oriented and customizable Python code that calculates accurate predictions for the expected rates in WIMP direct–detection experiments within the framework of Galilean–invariant non–relativistic effective theory in virtually any scenario, including inelastic scattering, an arbitrary WIMP spin and a generic WIMP velocity distribution in the Galactic halo. WimPyDD exploits the factorization of the three main components that enter in the calculation of direct detection signals: i) the Wilson coefficients of the effective theory, that encode the dependence of the signals on the ultraviolet completion of the effective theory; ii) a response function that depends on the nuclear physics and on the features of the experimental detector (acceptance, energy resolution, response to nuclear recoils); iii) a halo function that depends on the WIMP velocity distribution and that encodes the astrophysical inputs. In WimPyDD these three components are calculated and stored separately for later interpolation and combined together only as the last step of the signal evaluation procedure. This makes the phenomenological study of the direct detection scattering rate with WimPyDD transparent and fast also when the parameter space of the WIMP model has a large dimensionality.
We briefly summarize some of several published results obtained with WimPyDD so far as illustrative examples of its power and flexibility.

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