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Benchmarking FIMP signatures at future Higgs factories

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Feebly interacting massive particles (FIMPs) are characterised by very weak couplings and can be mediators to the dark sector or dark matter (DM) candidates themselves. In the latter case, the DM abundance is determined by the *freeze-in* mechanism (in contrast to *freeze-out* for WIMPs). Many FIMP scenarios are difficult to be constrained at the LHC and future e+e- Higgs factories seem to be a good place to look for them.

Typically, benchmark points (BPs) for studing collider sensitivity to Beyond the Standard Model (BSM) scenarios are selected in the model parameter space, providing predictions on the experimental signatures expected in a given experiment. We propose a different, more experiment-focused approach. A set of BPs is selected here to cover a range of experimental signatures, rather than a range of BSM model parameters.

The available space of physical FIMP parameters strongly depends on the particle type, coupling structure, and hence also the production scenario, which leads to particular signatures. Therefore, BPs are defined in the space of physical FIMP properties, directly related to the level of experimental sensitivity, for a given production channel and/or a signature. If FIMP is a mediator, this can be e.g. its mass, lifetime or branching ratios.

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