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Improved methods for the search of inverse Compton scattering and synchrotron radiation in dwarf galaxies. The case of annihilating or decaying Dark Matter

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In the context of cosmic-ray physics, we introduce a novel strategy for the computation of the inverse-Compton scattering (ICS) and synchrotron-radiation (SR) signals in dwarf galaxies. In particular, we identify various regimes where, in analogy to prompt gamma rays, the diffuse ICS and SR signals from dark matter annihilation/decay can be expressed as the multiplication of a halo times a spectral function. These functions are computed here for the first time for a number of benchmark cases. Our theoretical setup differs from previous work in that, instead of employing a method-of-images strategy, we consider a Fourier-mode expansion of the relevant Green's functions. With this strategy, exact results can be obtained with very low computational cost and for generic dark matter models. In particular, O(10 −100) Fourier modes can be easily incorporated into the computations in order to probe the smallest scales of the problem.

In addition, we propose a new strategy to search for dark matter using X-ray (ICS) or radio (SR) observations of dwarf galaxies that is (1) easy to implement and (2) free of the otherwise large degeneracies in the description of ICS or SR signals from dark matter.

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