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The SIMP and the vector meson

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The so-called "strongly interacting massive particles" (SIMPs) refer to a class of dark matter candidates with the relic abundance set by the $3 \to 2$ interactions which allows for dark matter with sub-GeV masses, not yet strongly constrained by direct detection experiments. Interestingly, SIMP dark matter features relatively strong self-interactions that may explain the small-scale structure puzzles. We investigate the realisation of SIMP models where dark pions form dark matter, protected from decay by dark flavour symmetries. We observe that the freeze-out mechanism for the dark pions depends sensitively on the masses of heavier states present, such as dark vector mesons. We improve on existing results by using recent lattice simulations connecting the masses of dark pions and vector mesons.

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