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Sterile neutrino portals to Majorana dark matter

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Stringent constraints on the interactions of dark matter with the Standard Model suggest that dark matter does not take part in gauge interactions. In this regard, the possibility of communicating between the visible and dark sectors via gauge singlets seems rather natural. We consider a framework where the dark matter talks to the Standard Model through its coupling to sterile neutrinos, which generate active neutrino masses. We focus on the case of Majorana dark matter, with its relic abundance set by thermal freeze-out through annihilations into sterile neutrinos. We use an effective field theory approach to study the possible sterile neutrino portals to dark matter. We find that both lepton-number-conserving and lepton-number-violating operators are possible, yielding an interesting connection with the Dirac/Majorana character of active neutrinos. In a second step, we open the different operators and outline the possible renormalisable models. We analyse the phenomenology of the most promising ones, including a particular case in which the Majorana mass of the sterile neutrinos is generated radiatively.

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