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Scalar versus vector dark matter

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We investigate and compare two simple models of dark matter (DM): a vector and a scalar DM. In the former case an extra gauged group factor $U(1)$ is introduced, and the DM is the corresponding massive gauge boson A^{μ}_{X}. The $U(1)$ symmetry is spontaneously broken by a vacuum of an extra scalar complex field S. Dark charge conjugation $A^{\mu}_{X} \to -A^{\mu}_{X}$ with $S \to S^{*}$ is responsible for stabilization of DM. In the latter case the gauge group remains standard, but an extra scalar complex field S is also introduced. The DM is an imaginary part of S and the stabilizing symmetry is also the dark charge conjugation $S \to S^{*}$. In this case, in order to avoid spontaneous breaking, the $U(1)$ symmetry is broken explicitly, but softly, in the scalar potential. The possibility to disentangle the two models has been investigated.

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