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Scalar field dark matter with spontaneous symmetry breaking and the 3.5 keV line

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We show that the present dark matter abundance can be accounted for by an oscillating scalar field that acquires both mass and a non-zero expectation value from interactions with the Higgs field. The dark matter scalar field can be sufficiently heavy during inflation, due to a non-minimal coupling to gravity, so as to avoid the generation of large isocurvature modes in the CMB anisotropies spectrum. The field begins oscillating after reheating, behaving as radiation until the electroweak phase transition and afterwards as non-relativistic matter. The scalar field becomes unstable, although sufficiently long-lived to account for dark matter, due to mass mixing with the Higgs boson, decaying mainly into photon pairs for masses below the MeV scale. In particular, for a mass of ~ 7 keV, which is effectively the only free parameter, the model predicts a dark matter lifetime compatible with the recent galactic and extragalactic observations of a 3.5 keV X-ray line.

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Classification de Session: Talks and group discussions