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Dynamical Generation of Dark Matter and Electroweak Scales

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The Standard Model (SM) of particle physics suffers from the hierarchy problem which can be ameliorated if all the scales that we observe in nature are considered not to be fundamental but generated dynamically in nature. As examples, we will discuss freeze-out and freeze-in production of vector dark matter (DM) in a classically scale invariant theory, where the Standard Model (SM) is augmented with an extended gauge symmetries that are spontaneously broken due to the non-zero vacuum expectation value (VEV) of a scalar. Generating the SM Higgs mass at 1-loop level, it leaves only two parameters in the dark sector, namely, the DM mass m_X and the gauge coupling g_X as independent. For freeze-in, which require very feeble coupling to satisfy the relic, the scenario is testable in several light dark sector searches (e.g., in DUNE and in FASER-II) as well as direct detection probes in a complementary manner courtesy to the underlying scale invariance of the theory.

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