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Dark photons in the decay of a scalar particle

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The couplings of the Standard Model sector to the scale invariant degrees of freedom can open the possibility to study the hypothesized particles called as dark photons (DP). The latter are associated with dark matter, neutralinos and others. The model for the DP particle solvable in 4-dimensional space-time is studied at the lowest order of perturbative theory using canonical quantization. The model is gauge and scale invariant and these symmetries are spontaneously broken with the following properties: the DP field is massive. The Dalitz-like decay of the (Higgs-like) scalar boson into a single photon and DP is studied. The interaction between DP and quarks is mediated by the derivative of the scalar field - the dilaton. The mass of the dilaton does not enter the final solutions. The limits are set on the DP mass, the mixing strength between the standard photon and DP. The emitted energy of the single photon is encoded with measuring of the missing of the recoil DP. This study can be used to probe the DP sector at current experimental facilities, and at new experiment FASER at the LHC which will be operational in 2021.

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