Ultralight dark photon can resolve the Hubble tension problem

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We consider a massive vector field as a model for early Universe dark matter. Assuming that the massive vector field interacts with the Standard Model matter very weakly and is produced non-thermally, we study the evolution of this field in early Universe during the radiation dominated epoch. We show that this field may be naturally created with the equation of state of radiation (w=1/3), but at some time a transition happens and the field behaves as cold dark matter (w=0). If a small fraction of dark matter is described by such massive vector fields, the expansion rate of the Universe is slightly enhanced at early time and, thus, the value of the sound horizon of baryon acoustic oscillations (standard ruler) is reduced. As a result, in this model the value of the Hubble constant appears to be larger than that in the standard LambdaCDM model. We show that for certain values of the parameters of mass and density of the massive vector field the Hubble tension problem may be naturally revolved.

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