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MeV new physics light from muon g-2

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The muon g-2 is an interesting observable, since it can be measured with great precision and can be computed with excellent accuracy within the Standard Model (SM). The current experimental measurement of muon g-2 shows a deviation to the SM prediction, which may be a hint of new physics. A light particle, scalar or vector, can be nature new physics candidates to explain the current muon g-2 result. If it is a light scalar with a mass around 1 MeV. It can be connected to the origin of neutrino masses and simultaneously survive current bounds on relativistic degrees of freedom in the early universe. If it is a light scalar with mass around pion mass and a coupling to muons of the order of the Standard Model Higgs coupling, it can be tested in the KOTO experiment. If it is a complex scalar with real part around 200 MeV, it can explain muon g-2 and can be tested via electron g-2 experiment. If the light particle for muon g-2 is a dark photon and its mass is time-varying due to environmental effects, for mass around tens of MeV, the muon g−2 solution from the kinetic mixing dark photon becomes viable again. The scenario can be further tested by reanalyzing the existing data with timing information included.

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