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Search for muon-philic new light gauge boson

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Motivated by the long-lasting 3.5σ discrepancy in the anomalous magnetic moment of muon, we consider a new muon-specific force mediated by a light gauge boson, X, with mass mX<2mμ and the coupling constant gX~(10−4,10−3). We show that the Belle II experiment has a robust chance to probe such a light boson in e+e−⟶μ+μ−+X channel and cover the most interesting parameter space explaining the discrepancy with the planned target luminosity 50 ab−1. The clean signal of muon-pair plus missing energy at Belle II can be a smoking gun for the new gauge boson. We expect that the (invisibly decaying) muon-philic light (mX<2mμ) gauge boson can be probed down to gX≥5×10−5 (1.5×10−4, 4×10−4) for 50 (10, 1) ab−1 search.

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