Abstract Submitted
for the APR21 Meeting of
The American Physical Society

No-Lose Theorem for Discovering the New Physics of (g 2) at Muon Colliders RODOLFO CAPDEVILLA, DAVID CURTIN, University of Toronto, YONI KAHN, University of Illinois Urbana Champaign, GORDAN KRNJAIC, Fermilab — The longstanding muon g 2 anomaly may indicate the existence of new particles that couple to muons, which could either be light (¡ GeV) and weakly coupled, or heavy (¿ 100 GeV) with large couplings. If light new states are responsible, upcoming intensity frontier experiments will discover further evidence of new physics. However, if heavy particles are responsible, many candidates are beyond the reach of existing colliders. Using a model-exhaustive approach we show that, if the (g 2) anomaly is confirmed and no explanation is found at low-energy experiments, a high-energy muon collider program at the TeV - 10 TeV scale is guaranteed to make fundamental discoveries about our universe, either directly discovering new BSM states that account for g-2, or detecting indirect signatures of their existence while proving that their mass is close to the 100 TeV upper bound from perturbative unitarity. The latter is only theoretically consistent if the universe if fine-tuned and the flavour problem of the SM is solved non-minimally. In any scenario, a muon collider program is guaranteed to make fundamental discoveries about our universe. Based on 2006.16277 and ongoing investigations.

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Date submitted: 08 Jan 2021 Electronic form version 1.4