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Edge quantum criticality and emergent supersymmetry in topological phases.

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Proposed as a fundamental symmetry describing our universe, spacetime supersymmetry (SUSY) has not been discovered yet in nature. Nonetheless, it has been predicted that SUSY may emerge in low-energy physics of quantum materials such as topological superconductors and Weyl semimetals. Here, by performing state-of-the-art sign-problem-free Majorana quantum Monte Carlo (QMC) simulations of an interacting 2D topological superconductor, we show convincing evidences that the N=1 SUSY emerges at its edge quantum critical point (EQCP) while its bulk remains gapped and topologically nontrivial. Remarkably, near the EQCP, we find that the edge Majorana fermion acquires a mass which is identical with that of its bosonic superpartner. To the best of our knowledge, this is the first observation that fermions and bosons have equal dynamically-generated masses, a hallmark of emergent SUSY. We further discuss experimental signatures of such EQCP and the associated edge SUSY. Ref: Zi-Xiang Li, Yi-Fan Jiang, Hong Yao, arXiv:1610.04616.