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Topological protection, disorder, and interactions: Life and death at the surface of a topological superconductor[1] MATTHEW FOSTER, HONGYI XIE, YANG-ZHI CHOU, Rice University — The key attribute of a 3D topological phase of matter is the prediction of robust, gapless surface states. These are said to be protected from the effects of disorder, in the sense that these states escape Anderson localization. Sufficiently weak interactions also have negligible effect, at least for surface states doped to the Dirac point. Here we consider the *combined* effects of disorder and interactions on the surface states of 3D topological superconductors. Generalizing previous work [Foster and Yuzbashyan, PRL 109, 246801 (2012)], we study the enhancement of interactions due to disorder-mediated wavefunction multifractality, and the suppression of the Altshuler-Aronov correction to the surface quasiparticle spin conductance, due to the topology. We construct global surface state phase diagrams employing numerics, perturbative Finkel'stein non-linear sigma model calculations, and exact conformal field theory results. We establish the restrictive conditions under which surface states can be robust to both disorder and interactions.

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Matthew Foster
Rice University

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