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Local criticality, diffusion and chaos in generalized Sachdev-Ye-Kitaev models YINGFEI GU, XIAO-LIANG QI, Stanford Univ, DOUGLAS STANFORD, IAS — The Sachdev-Ye-Kitaev model is a $(0+1)$-dimensional model describing Majorana fermions or complex fermions with random interactions. This model has various interesting properties such as approximate local criticality (power law correlation in time), zero temperature entropy, and quantum chaos. In this article, we propose a higher dimensional generalization of the Sachdev-Ye-Kitaev model, which is a lattice model with N Majorana fermions at each site and random interactions between them. Our model can be defined on arbitrary lattices in arbitrary spatial dimensions. In the large N limit, the higher dimensional model preserves many properties of the Sachdev-Ye-Kitaev model such as local criticality in two-point functions, zero temperature entropy and chaos measured by the out-of-time-ordered correlation functions. In addition, we obtain new properties unique to higher dimensions such as diffusive energy transport and a "butterfly velocity" describing the propagation of chaos in space. We mainly present results for a $(1+1)$-dimensional example, and discuss the general case near the end.

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