Topological Random Fractals

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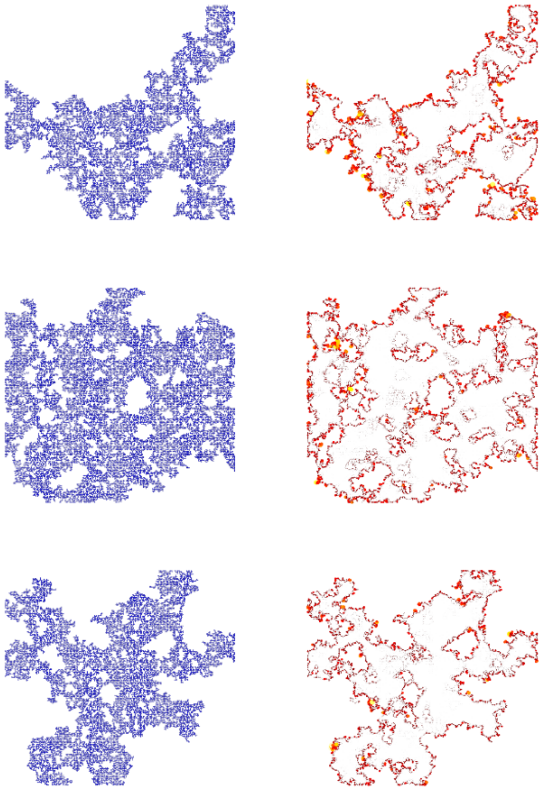
The search for novel topological quantum states has recently moved beyond naturally occurring crystalline materials to complex and engineered systems. In this work we generalize the notion of topological electronic states to random lattices in non-integer dimensions. By considering a class *D* tight-binding model on critical clusters resulting from a two-dimensional site percolation process, we demonstrate that these topological random fractals exhibit the hallmarks of topological insulators. Specifically, our large-scale numerical studies reveal that topological random fractals display a robust mobility gap, support quantized conductance and represent a well-defined thermodynamic phase of matter. The finite-size scaling analysis further suggests that the critical properties are not consistent with the expectations of class *D* systems in two dimensions, hinting to the nontrivial relationship between fractal and integer-dimensional topological states. Our results establish topological random fractals as the most complex systems known to support nontrivial band topology with their distinct unique properties.



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