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Quantum Simulation of Hyperbolic Systems using Circuit QED Lattices[1] ALICIA KOLLAR, MATTIAS FITZPATRICK, ANDREW HOUCK, Princeton University — The field of circuit QED has emerged as a rich platform for both quantum computation and quantum simulation. The unique deformability of coplanar waveguide microwave resonators enables realization of artificial photonic materials which cannot be made from ordinary atomic or ionic systems. In this talk, we present one such example where we fabricate a two-dimensional periodic lattice in a hyperbolic space of constant negative curvature. This lattice constitutes an artificial material which exists in a region of extreme gravitation or in anti-de Sitter space. Particles in the lattice propagate along geodesics of the hyperbolic metric, rather than along the standard straight lines of flat Euclidean space, and it displays a highly unusual band structure with a gapped flat band. With the addition of high-kinetic-inductance materials or transmon qubits these systems will constitute a table-top simulator of interacting and quantum mechanical particles in strong curvature.

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