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Nonsymmorphic topological photonic crystal with a single surface Dirac cone LING LU, CHEN FANG, LIANG FU, STEVEN JOHNSON, JOHN JOANNOPOULOS, MARIN SOLJACIC, MIT, MIT COLLABORATION — We predict a realization of the nonsymmorphic topological crystalline phase: a three-dimensional (3D) photonic crystal with a single surface Dirac cone. A single Dirac cone on the surface is the hallmark of the 3D topological insulators, where the double degeneracy at the Dirac point is protected by time-reversal symmetry and the spin-splitting away from the point is provided by the spin-orbital coupling. In our 3D topological photonic crystal, the degeneracy at the Dirac point is protected by a nonsymmorphic glide reflection and the linear splitting away from it is enabled by breaking time-reversal symmetry. Such a gapless surface state is fully robust against random disorder of any type. This bosonic topological band structure is achieved by applying alternating magnetization to gap out the 3D "generalized Dirac points" discovered in the bulk of our crystal. The Z2 bulk invariant is characterized through the evolution of Wannier centers. Our proposal–readily realizable using ferrimagnetic materials at microwave frequencies–can also be regarded as the photonic analog of topological crystalline insulators, providing the first 3D bosonic symmetry-protected topological system.

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