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Topological Waves in Plasmas and Analogs to Topological Insulators[1] JEFFREY PARKER, Lawrence Livermore Natl Lab, BRAD MARSTON, Brown University, STEVE TOBIAS, University of Leeds, ZIYAN ZHU, Havard University — A topological understanding of matter is not only deepening our knowledge of physics, but also leading to novel practical devices and applications. Topological insulators have led to a surge in interest in the topological protection and robustness to backscatter afforded to particular unidirectional edge modes. While these concepts were originally developed in photonic systems and electronic structures, recent advances have demonstrated that continuum fluid systems can support topological waves. We identify a specific candidate for a topological plasma wave. To be concrete, the wave is an electromagnetic RF surface wave propagating at the boundary between magnetized plasma and vacuum. The magnetic field breaks time-reversal symmetry. Using the cold-plasma model, we show that a plasma can be characterized by a nontrivial Chern number, although regularization of the Hamiltonian is required for the integral of the Berry curvature to yield an integer Chern number. Moreover, we perform detailed theoretical calculations and demonstrate that this wave could exist at plasma parameters achievable in existing laboratory devices. Experiments to confirm the existence of this wave would open a new frontier in the exploration of the physics of topological waves in plasmas.

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