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Dynamics of Josephson vortex interacting with Majorana bound modes in Long Josephson Junctions YEN LEE LOH, JU H. KIM, University of North Dakota — We investigate the effects of Majorana bound modes on Josephson vortex (i.e., fluxon) dynamics by examining a long Josephson junction deposited on a topological insulator. Majorana bound states are represented as two counterpropagating edge modes along either superconducting side, which couples to the local Josephson phase difference. A fluxon (a 2π phase configuration) interacts with Majorana bound states via the Jackiw-Rebbi mechanism [1] as pointed out by Grosfeld and Stern [2]. We find the effective equation of motion for the fluxon by integrating out the Majorana modes. This motion can be described by the double sine-Gordon equation. As a consequence, there may be fractional Shapiro steps in the I-V characteristics. In addition, the fluxon may have internal modes. We study the criteria for these effects to occur and to be detectable.

[1] R. Jackiw and C. Rebbi, Phys. Rev. D **13**, 3398 (1976).
[2] E. Grosfeld and A. Stern, PNAS **108**, 11810 (2011).

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