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Frequency structure of the nonlinear instability of a dragged viscous thread STEPHEN W. MORRIS, Dept. of Physics, University of Toronto, ROBERT L. WELCH, Dept. of Physics, McGill University, BILLY SZETO, Dept. of Physics, University of Toronto — A thread of viscous fluid falling onto a moving belt exhibits a spectacular variety of modes of motion as the belt speed and nozzle height are varied [1]. For modest nozzle heights, four clear regimes are observed. For large belt speed, the thread is dragged into a stretched centenary configuration which is confined to a plane. As the belt speed is lowered, this exhibits a supercritical Hopf bifurcation to a meandering mode [2]. At very low belt speeds, the motion resembles the usual coiling motion of a viscous thread falling on a stationary surface. In between the meandering and coiling regimes, a window of novel multifrequency motion, previously called "figures of eight" is found. We examined the longitudinal and transverse motion of the thread in all these states, using an automated apparatus that allows a detailed exploration of the parameter space. We found that the multifrequency window is characterized by a complex pattern of motion whose main frequencies are locked in a 3:2 ratio. This motion appears and disappears with finite amplitude at sharp bifurcations, without measurable hysteresis.

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[2] S. W. Morris, J. H. P. Dawes, N. M. Ribe and J. R. Lister, Phys. Rev. E, 77, 066218 (2008).

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