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Modulational instability and its role in the formation of matter-wave soliton trains[1] DE LUO, JASON H. V. NGUYEN, RANDALL G. HULET, Department of Physics and Astronomy, Rice University — Modulational instability (MI) is a process by which perturbations at a critical wavelength in a waveform grow exponentially due to the interplay between a focusing nonlinearity and dispersion. The break-up of the waveform can lead to the formation of soliton trains. It was observed that matter-wave soliton trains form from a Bose-Einstein condensate, after an interaction quench from a repulsive to an attractive nonlinearity[2]. An alternating phase structure was inferred from the dynamics of the soliton train, in which adjacent solitons repel one another. The mechanism by which the phase structure develops remains unclear. In this work, we examine the role of MI in the formation of the matter-wave soliton trains. We confirm that MI correctly predicts the number of solitons and the time-scale of the formation process. With real-time imaging, we provide evidence that the soliton train is born with an alternating phase structure, rather than evolving into one.

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[2]K. E. Strecker, G. B. Partridge, A. G. Truscott, and R. G. Hulet, Nature 417, 150 (2002)

De Luo
Department of Physics and Astronomy, Rice University

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