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Solitary waves become localized modes in granular chains with soft grains

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Granular chains have numerous applications, ranging from shock absorption and vibration reduction, to detecting buried objects, to energy localization. As energy is transferred between grains they deform slightly, and the contact potential arising from the elastic deformation of grains is given by the Hertz law. The discrete nature of these systems in combination with the nonlinear contact force between neighboring grains leads to complex collective behavior. I will discuss the dynamics of granular chains and, in particular, will show how solitary wave propagation in these systems is affected by grain softness, and how introducing inertial mismatches affects the reflection of solitary waves at boundaries. I will further show how initial solitary wave energy can be trapped into localized modes with predictable frequencies in chains with soft central grains.

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