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Observation of Breathers in an Attractive Bose Gas

Recent work conducted at the ANU has resulted in the first observation of matter-wave breathers—dispersionless soliton-like states with collective oscillation frequencies driven by attractive mean-field interactions. This was achieved by taking precise measurements of the width of a ^{85}Rb condensate as a function of time in the attractive two-body interaction regime. Curiously, it was observed that the stability of these breathers in the negative scattering regime extended well beyond what is predicted by the standard Gross-Pitaevskii equation (GPE). Moreover, the predicted oscillation frequencies and dynamics of the expanded cloud disagreed with GPE predictions. It was found that incorporating a three-body scattering term accurately models the observed breather behaviour.

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