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## Granulation in an atomic Bose-Einstein condensate

Granular matter is ubiquitous in nature, appearing in a wide range of patterns bearing characteristics reminiscent of plasma, gas, liquid or solid phases. Grain sizes range from microns to many kilometers -- from dust speckles to large plasma cells found in the Sun or stars. Despite its omnipresence, the realization of this extraordinary state of matter in atomic or quantum systems has not yet been observed. We provide such a characterization by experimentally and theoretically investigating the formation of granular states and their beyond-mean-field physics in an elongated Bose-Einstein condensate. We demonstrate that they exhibit non-local quantum many-body correlations and their stability is attributed to quantum fluctuations. Additionally and similarly to conventional granulation, they feature different -- quantum -- phases like turbulence and localization.