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Multistability and Critical Fluctuation in a Split Bose-Einstein Condensate

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Abstract: By using a two-mode description, we show that there exist the multistability, phase transition and associated critical fluctuations in the macroscopic tunnelling process between the halves of a double-well trap containing a Bose-Einstein condensate. The phase transition that two of the triple stable states and an unstable state merge into one stable state or a reverse process takes place whenever the ratio of the mean field energy per particle to the tunnelling energy goes across a critical value of order one. The critical fluctuation phenomenon corresponds to squeezed states for the phase difference between the two wells accompanying with large fluctuations of atom numbers.

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