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Spontaneously Created Attractive Bose-Einstein Condensates and Their Critical Behaviors YIPING CHEN, MUNEKAZU HORIKOSHI, KOSUKE YOSHIOKA, MAKOTO KUWATA-GONOKAMI, The University of Tokyo
— Bose-Einstein condensate (BEC) is a type of continuous phase transition. In general, when a continuous phase transition occurs on a finite timescale, it leads to defect and structure formation. This behavior is predicted to obey certain power law scaling in accordance to their universality class by the Kibble-Zurek mechanism. Experiments conducted in various system including repulsive BEC support this mechanism. However, the situation of attractive BEC remains ambiguous due to the lack of experimental observation. Here, we explore this phenomenon using a weakly attractive Bose gas with tunable interaction that is cooled by a fermionic coolant in an elongated trap. By controlling the timescale of the phase transition, we find that the gas subsequently forms a diverse number of bright solitons for attractive interaction and gray solitons for repulsive interaction. The power law scaling of the average soliton number over the timescale of the phase transition is measured. The results show that both attractive BEC and repulsive BEC obey the same power law scaling, which supports the idea of universality.

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