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Collapse and stable self-trapping for Bose-Einstein condensates with 1/r^b type attractive interatomic interaction potential

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(Submitted on 7 Feb 2010)

We consider dynamics of Bose-Einstein condensates with long-range attractive interaction proportional to $1/r^b$ and arbitrary angular dependence. It is shown exactly that collapse of Bose-Einstein condensate without contact interactions is possible only for $b \ge 2$. Case $b=2$ is critical and requires number of particles to exceed critical value to allow collapse. Critical collapse in that case is strong one trapping into collapsing region a finite number of particles. Case $b>2$ is supercritical with expected weak collapse which traps rapidly decreasing number of particles during approach to collapse. For $b<2$ singularity at $r=0$ is not strong enough to allow collapse but attractive $1/r^b$ interaction admits stable self-trapping even in absence of external trapping potential.

Subjects:	**Pattern Formation and Solitons (nlin.PS)**; Chaotic Dynamics (nlin.CD)
Cite as:	**arXiv:1002.1469v1 [nlin.PS]**

Submission history

From: Pavel M. Lushnikov [view email]
[v1] Sun, 7 Feb 2010 17:19:44 GMT (39kb)

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