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Stable vortices in Bose-Einstein condensate dark matter

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The nature of dark matter (DM) is one of the most fascinating unresolved challenges of modern physics. One of the perspective hypotheses suggests that DM consists of ultralight bosonic particles in the state of Bose-Einstein condensate (BEC). The superfluid nature of BEC must dramatically affect the properties of DM including quantization of the angular momentum. Angular momentum quantum in the form of a vortex line is expected to produce a considerable impact on the luminous matter in galaxies including density distribution and rotation curves.
We investigate the general properties and stability of spinning DM cloud with typical galactic halo mass and radius. Analytically and numerically stationary vortex soliton states with different topological charges have been analyzed. It has been shown that while all multi-charged vortex states are unstable, a single-charged vortex soliton is extremely robust and survives during the lifetime of the Universe.
Binary collisions between two spinning DM clouds are then studied. Remarkably, vortex solitons may pass right through each other in a quasi-elastic head-on collision. The interacting BEC clouds display an interference pattern as they pass through each other, recovering their vortex identities after the collision. Since the vortex solitons appear to be very robust structures it opens a perspective for their observation in the Universe for different scales: from bosonic stars to large-scale galactic haloes.

Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

Dr. Alexander Yakimenko, Department of Physics, Taras Shevchenko National University of Kyiv, Ukraine, qft.univ.kiev.ua

Internet talk

Yes

Primary author: Dr YAKIMENKO, Alexander (Taras Shevchenko National University of Kyiv)

Co-authors: Ms NIKOLAIEVA, Yelyzaveta (Department of Physics, Taras Shevchenko National University of Kyiv,); Prof. VILCHYNSKII, Stanislav (Department of Physics, Taras Shevchenko National University of Kyiv)

Presenter: Dr YAKIMENKO, Alexander (Taras Shevchenko National University of Kyiv)

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