Contribution ID: **20** Type: **Poster**

Vortex spin in a Bose-Einstein condensate

Monday 2 September 2024 17:00 (2 hours)

General relativity predicts that the curvature of spacetime induces spin rotations on a parallel transported particle. We deploy Unruh's analogue gravity picture and consider a quantised vortex embedded in a two-dimensional superfluid Bose-Einstein condensate. We show that such a vortex behaves dynamically like a charged particle with a spin in a gravitational field in a 2+1 dimensional spacetime [1-3]. The way the fermionic, split-boson, quasiparticle character of the vortex particle emerges out of bosons trapped by the vortices parallels the emergence of Majorana quasiparticles as split-fermions in the vortex cores of topological Fermi superfluids.

References

[1] Emil Génetay Johansen, Tapio Simula, Vortex spin in a superfluid, arXiv:2305.16016.

[2] E. Génetay Johansen, C. Vale, T. Simula, Quantum double structure in cold atom superfluids, AVS Quantum Sci. 5, 033201 (2023).

[3] Emil Génetay Johansen, Tapio Simula, Topological quantum computation using analog gravitational holonomy and time dilation, SciPost Phys. Core 6, 005 (2023).

Short bio (50 words) or link to website

https://www.swinburne.edu.au/research/our-research/access-our-research/find-a-researcher-or-supervisor/researcher-profile/?id=tsimula

Relevant publications (optional)

T. Simula, N. Kjærgaard, T. Pfau, Topological transport of a classical droplet in a lattice of time, arXiv:2403.06500. https://arxiv.org/abs/2403.06500

Emil Génetay Johansen, Tapio Simula, Vortex spin in a superfluid, arXiv:2305.16016. https://arxiv.org/abs/2305.16016

Rama Sharma, Tapio P Simula, Andrew J Groszek, Fluctuation theorem anomaly in a point-vortex fluid, arXiv:2308.03397.
https://arxiv.org/abs/2308.03397

Career stage

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