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Creating and Manipulating Dirac Strings in Spinor Condensate

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Artificial monopoles have been engineered in various systems, yet there has been no systematic study of the singular vector potentials associated with the monopole field. We show that the Dirac string, the line singularity of the vector potential associated with the monopole field, can be engineered, manipulated, and made manifest in a spinor atomic condensate. We elucidate the connection among spin, orbital degrees of freedom, and the artificial gauge, and show that there exists a mapping between the vortex filament and the Dirac string. We also devise a proposal where preparing initial spin states with relevant symmetries and then adiabatically turn on the effective monopole field can result in different vortex patterns, revealing an underlying correspondence between the internal spin states and the spherical vortex structures [1]. Such a mapping also leads to a new way of constructing spherical Landau levels, and monopole harmonics. Our observation provides insights into the behavior of quantum matter possessing internal symmetries in curved spaces.

[1] arXiv:2402.14705

References

Short bio (50 words) or link to website

Han Pu obtained his Ph.D. in physics in 1999 and is currently a professor at Rice University. His research interest lies in theoretical cold atoms, quantum optics and quantum many-body physics. He is a Fellow of the American Physical Society.

Relevant publications (optional)

arXiv:2402.14705

Career stage

Professor

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Track Classification: FINESS