



[original insight]

Diamond Open Access

Spin is a superposition of circular charged trajectories

Open Physics Collaboration^{*†}

July 2, 2019

Abstract

Connecting classical electromagnetism, quantum superposition of trajectories and the motion of a superposition of the elementary charge distribution of the electron, we conclude that spin is a quantum superposition of circular charged trajectories.

keywords: electron, spin, superposition of trajectories, charge distribution

Introduction

1. Spin remains a very profound mystery, not completely understood to the present date [1].
2. In this work, we are using metamathematical logic applied to physics, in order to connect the physical properties mentioned in the abstract.

^{*}All authors with their affiliations appear at the end of this paper.

[†]Corresponding author: mplobo@uft.edu.br | Join the Open Physics Collaboration

Elementary charge distribution in motion

3. Electric charges in motion generate magnetic field.
4. Quantum trajectories are in quantum superposition [2].
5. **Conjecture:** electron = point + charge.
6. In (5), “point” means a point field in the rest frame of the electron.
7. In (5), “charge” means a *charge distribution*, i.e., the fundamental charge e is in a quantum superposition over a region of space.
8. Due to quantum fluctuations (the uncertainty principle), the charge e is *orbiting* the *point*.
9. In this sense, the electron has a size.
10. The *point* and the *charge* are entangled.
11. This orbit is circular as shown here [3,4].

Note

12. In the quantum realm, there is probably a superposition of tiny fractions of e .

Final Remarks

13. Spin is related to a quantum superposition of circular trajectories of the electron’s charge distribution.
14. There are only two distinct directions of motion (clockwise and counterclockwise) in each plane.
15. Spin up is clockwise; spin down, counterclockwise, for example.

16. Can one dissociate the point and the charge of the electron by means of the quantum Cheshire cat [5]?

Open Invitation

Please *review* this article, *add* content, and *join* the **Open Physics Collaboration**. Contact mplobo@uft.edu.br.

Ethical conduct of research

This original work was pre-registered under the OSF Preprints [6], please cite it accordingly [7]. This will ensure that researches are conducted with integrity and intellectual honesty at all times and by all means.

References

- [1] Tomonaga, Sin-Itiro. *The story of spin*. University of Chicago Press, 1997.
- [2] Zee, Anthony. *Quantum field theory in a nutshell*. Princeton university press, 2010.
- [3] Ohanian, Hans C. “What is spin?.” *American Journal of Physics* 54.6 (1986): 500-505.
- [4] Lobo, Matheus P. “Spin Is a Circulating Field.” *OSF Preprints*, 30 June 2019. <https://doi.org/10.31219/osf.io/khnpj>
- [5] Denkmayr, Tobias, et al. “Observation of a quantum Cheshire Cat in a matter-wave interferometer experiment.” *Nature communications* 5 (2014): 4492.
- [6] COS. *Open Science Framework*. <https://osf.io>

- [7] Lobo, Matheus P. “Spin Is a Superposition of Circular Charged Trajectories.” *OSF Preprints*, 30 June 2019. <https://doi.org/10.31219/osf.io/tv2rb>

The Open Physics Collaboration

Matheus Pereira Lobo

Federal University of Tocantins (Brazil)