

Realization of a complete Stern-Gerlach interferometer: Towards a test of quantum gravity

Ron Folman

Ben-Gurion University of the Negev, POB 653, Beer Sheva, Israel

The Stern-Gerlach effect, found a century ago, has become a paradigm of quantum mechanics. Unexpectedly, until recently, there has been little evidence that the original scheme with freely propagating atoms exposed to gradients from macroscopic magnets is a fully coherent quantum process. Several theoretical studies have explained why a Stern-Gerlach interferometer is a formidable challenge. Here, we provide a detailed account of the realization of a full-loop Stern-Gerlach interferometer for single atoms and use the acquired understanding to show how this setup may be used to realize an interferometer for macroscopic objects doped with a single spin. Such a realization would open the door to a new era of fundamental probes, including the realization of previously inaccessible tests at the interface of quantum mechanics and gravity.