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Topological phases in atoms and molecules in spin-polarized electron scattering[1] JAMES WILLIAMS, LUKA PRAVICA, SERGEY SAMARIN, SUDARSHAN KATHI, PAUL GUAGLIARDO, The University of Western Australia, CENTRE FOR ATOMIC, MOLECULAR AND SURFACE PHYSICS TEAM
— Observations of spin-polarized electron impact excitation of zinc atoms, ionization of helium atoms and dissociative excitation of molecules indicate a topological phase. The parallel transport of the spin vector gives rise to an effective 'monopole' magnetic field and an apparent spin-orbit interaction. In excitation, the Stokes parameters of radiated photons show alignment and orientation. Excitation of a superposition of 2s and 2p states on atomic hydrogen in an external electric field show beats in Lyman alpha radiation as predicted for a circular vortex. Ionization of helium atoms show minima in (e,2e) angular and energy differential cross sections associated with a linear vortex (Macek, Feagin). Exchange dissociative excitation of methane shows radiated photons from a Jahn-Teller "avoided crossing" of potential energy curves (Mead and Truhlar). The observations are consistent with fundamental principles that a gauge–invariant quantity is potentially a physical observable and the topology of a ring indicates a magnetic-flux line enclosed by the ring is equivalent to a vortex line.

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