

A physical explanation for the connection between the electron spin and statistics

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Which is the physical agent behind the spin-statistics connection? Despite their enormous impact on the whole of physics, the antisymmetry of the electron wave function and the associated Pauli principle are commonly taken in quantum mechanics as empirical facts. The spin itself has been shown in stochastic electrodynamics (SED) to result from the coupling of the electron to circularly polarized modes of the electromagnetic vacuum, taken as a real fluctuating field. In this work, profiting from the fact that for a bipartite system the entangled state function as given by SED reproduces the quantum result but still contains information about the vacuum field mode that mediates between the particles, we show that the electrons couple in antiphase to the same field mode. This finding, encoded in the antisymmetry of the state vector, provides a physical rationale for the Pauli exclusion principle.

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