

The Stern-Gerlach Interferometer and the Twin Atoms

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In 1988, Englert, Schwinger and Scully [1] proposed an atomic polarization interferometer, in which the interference is caused by the evolution of the internal states under the action of external electromagnetic fields. Applying two of these interferometers to the gedanken experiment of David Bohm [2], based on the EPR article [3], we could rebuild the coherent states that would be destroyed in the measurement process. Thus it would be possible to maintain coherence between two atomic fragments originated from the same molecular state, the twin atoms.

The Stern-Gerlach interferometer consists of five main parts. The first one of them is the polarizer and this is the object of study of this work. Its purpose is to eliminate the unwanted states of the atom under study in order to have a beam with well-defined state in the next stages of the interferometer. We have chosen to investigate the production of pairs of metastable atoms originated from the dissociation of the molecule after collision with a pulsed electron beam [4,5,6]. In this case, the polarizer will eliminate two of the four hyperfine states. To this end, a magnetic field is applied to induce the combination of the metastable states with the states, which decay quickly to the state. This process is known as quenching and is caused by the electric field felt by the atom due to its velocity. It is necessary then to define the parameters of the permanent magnet to produce the quenching of the

atoms, that is, to define how the polarizer should be built and calculate the evolution of the four hyperfine states of the hydrogen atom in this field.

The study of the entanglement between two atomic fragments will be a new experiment and the application of the Stern-Gerlach interferometer to this analysis was never published.

Referências

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