Experimental Proposal: Interference Pattern Depending on Particle Mass

Objective:

To expand the classic double-slit experiment by varying the mass of the interfering particles, in order to detect potential field-induced structural changes in the interference pattern.

Hypothesis:

According to this field theory, each particle is surrounded by a physically real field. This field interacts with other surrounding fields (e.g., those of the slit material, the measurement apparatus, or the background). The greater the particle's mass (or the internal field intensity), the stronger the interaction with the environment. As a result, the interference pattern is determined not solely by the de Broglie wavelength, but by the combination of wave character and field coupling.

Expected deviation from the standard model:

In quantum mechanics, the shape of the interference pattern depends solely on the wavelength, i.e., the particle's momentum. If the particle's velocity is adjusted to keep the de Broglie wavelength constant, different particle masses should yield identical interference patterns. This field theory, however, predicts an additional structural change, such as:

- Modified contrast of the maxima,
- Broadened or asymmetric intensity distributions,
- Potentially shifted interference positions.

Setup:

A conventional double-slit setup with identical slit geometry is used, but the particles vary in mass:

- Electrons,
- Neutrons,
- C60 fullerenes,

- Optionally nanoparticles (depending on technical feasibility).

The particle velocities are adjusted so that their de Broglie wavelengths remain constant. The resulting interference patterns are recorded using high-resolution detectors (e.g., CCD cameras or phosphor plates) and analyzed in terms of their fine structure.

Relevance:

While interference with massive particles has already been demonstrated (e.g., Arndt et al., Nature 401, 1999), no systematic study has been published that analyzes the fine structure of the pattern at constant wavelength as a function of particle mass. Any deviation would be a strong indicator of field-dependent coupling effects - and thus support the validity of this theory of physically real fields.