

A new test of local Lorentz invariance in a photon system

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(invited)

SUMMARY. – We discuss the theoretical foundations and the results of a double slit diffraction-like experiment in the infrared range, aimed at finding departures from the classical predictions. We found indeed an anomalous behaviour of such a photon system. Possible interpretations can be given in terms of either the existence of de Broglie-Bohm hollow waves associated to photons, and/or a breakdown of local Lorentz invariance (LLI). The findings of the present experiment do agree with the threshold behaviour in energy and space, recently derived (on an experimental basis) for the LLI breaking effect. This leads us to put forward the intriguing hypothesis that the hollow wave is a deformation of the space-time (Minkowskian) geometry. Our experimental results can be tested in photon crossed beam experiments, which can evidence a possible anomalous behaviour in the photon-photon cross section.

1. Introduction

It is well known the basic role played by optical experiments in testing the very foundations of physics. It is enough to quote *e.g.* the Michelson-Morley interference experiment, as a fundamental test of Special Relativity, and the Davisson-Germer diffraction of electrons by a crystal lattice, which checked the wave nature of particles.

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