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Experiments with a pulsed Talbot Lau matter-wave interferometer

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ABSTRACT

According to the quantum superposition principle, massive particles can be delocalized and propagate through space as waves of matter. To date, it is not known whether this principle holds for particles of all masses or if there exists a mass limit to its validity. I present the optical time-domain matter-wave (OTIMA) interferometer, an experiment that was designed to probe such superposition states of large particles. The setup utilizes three pulsed standing wave laser gratings which imprint a periodic pattern onto the traversing matter waves through photo depletion of the particle density at the standing wave antinodes. I present experimental progress in characterizing the interferometer and discuss systematic effects on the interference contrast. First results of interference experiments with tailor-made nanoparticles are presented and discussed in the context of high-mass matter-wave interferometry. On the applied side, various different schemes for spectroscopy in the OTIMA interferometer are discussed.