Q 67: Poster Teilchenoptik

Zeit: Donnerstag 16:30–18:30 Raum: Poster C

Q 67.1 Do 16:30 Poster C

Matter wave interferometry for detecting collision between K atoms and K_2 molecules — •Sha Liu, Ivan Sherstov, Horst Knöckel, Christian Lisdat, and Eberhard Tiemann — Institut für Quantenoptik, Universität Hannover, Welfengarten 1, 30167 Hannover

We apply the method of matter wave interferometry implemented for K_2 molecules to investigate cold collisions between K atoms and molecules. The matter wave is coherently split and recombined by laser fields in a Ramsey-Bordé configuration. The two exits of this interferometer, with molecules in the excited state or in the ground state, give complementary detection schemes of the interference signal. The goal of this experiment is to investigate the suitability of such interferometer as a detector for collisions and to interpret the observed changes of the interference pattern in terms of the interaction potential between K and K_2. By means of resonant laser light, atoms are deflected out of the molecular beam and the atomic density decreases by one order of magnitude. Under such conditions we observe a phase shift of the interference structure relating to a pressure shift in the order of 10kHz for the selected molecular transition of K_2. The detection scheme for the ground state exit is set downstream of the particle beam sufficiently away from the interferometer zone for a good separation of the signals of both exits. Although the signals are in principle complementary to each other and can be recorded simultaeously, due to additional freedom in the experiment the ground state exit gives simpler profiles of the signals. The actual status of the experiment will be presented.

Q 67.2 Do 16:30 Poster C

The Visualization of the Gödel Universe — •Michael Buser[1], Endre Kajari[2], Wolfgang P. Schleich[3], Frank Grave[4], Hanns Ruder[5], and Günter Wunner[6] — [1]Universität Ulm — [2]Universität Ulm — [3]Universität Tübingen — [4]Universität Tübingen — [5]Universität Tübingen — [6]Universität Stuttgart

An intriguing solution of Einstein's field equations was found by Kurt Gödel in 1949. The Gödel universe describes a homogenous rotating universe in which closed time-like wordlines exist. Traveling along such a wordline allows an observer the mind-boggling journey into his own past. We discuss some properties of the metric, in particular its symmetries, and consider the propagation of light in that universe. It is well known that an optical horizon exists and that a lensing effect can be observed. In our main focus is the bending of the light rays in this universe and how they influence what an observer would see. For that purpose we use ray tracing, a well known method in computer graphics, and show how that technique can be applied to Gödel's universe.

Q 67.3 Do 16:30 Poster C

Matter wave Talbot-Lau interferometry beyond the eikonal approximation — •Stefan Nimmrichter and Klaus Hornberger — Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilians-Universität München

Our project deals with the theoretical description of a near-field matter wave interference experiment using the Talbot-Lau setup. Typically, it consists of three equal gratings, the second one responsible for the actual interference effect. It is particularly suited to demonstrate the wave nature of large molecules [1]. Unlike in far-field interference, the precise form of the interaction between the beam particles and the grating wall plays a decisive role for the quantitative description of the interference contrast. So far, the eikonal approximation has been sufficient for calculating the interference signal [2]. However, it ceases to be valid for beam molecules with masses beyond 2000 amu. Our aim is to develop a systematic framework for constructing higher order approximations of the grating interaction in the passage propagator for both the quantum and the classical treatment. The description will be based on the Wigner-Weyl representation of quantum mechanics. In particular, this permits to compare the quantum predictions with the corresponding classical model.

[1] Hackermüller et al., Phys. Rev. Lett. 91, 090408 (2003)
[2] Hornberger et al. Phys. Rev. A 70, 053608 (2004)