

Q 4 Poster Teilchenoptik

Zeit: Freitag 11:00–12:30

Raum: Poster HU

Q 4.1 Fr 11:00 Poster HU

Molecule interferometry: Sensitivity to inertial forces and vibrational dephasing — ●ALEXANDER STIBOR¹, KLAUS HORNBERGER², LUCIA HACKERMÜLLER¹, STEFAN GERLICH¹, ANTON ZEILINGER¹, and MARKUS ARNDT¹ — ¹Institut für Experimentalphysik, Universität Wien, Boltzmanngasse 5, 1090 Wien — ²Theoretische Quantenoptik, Ludwig-Maximilians-Universität, Theresienstraße 37, 80333 München

We discuss matter wave experiments in a near-field interferometer and focus on dephasing caused by inertial forces. They can significantly influence the observed interference contrast, even though they do not lead to genuine decoherence. We provide quantitative estimates for the most important effects which are the rotation of the earth, the gravitational acceleration as well as grating vibrations. The vibrations segregate into various coupled mode oscillations, most importantly the 'fixed pendulum' and the 'torsion pendulum' mode, as well as into independent grating oscillations. Furthermore our experiments reveal a strong influence of acoustic noise. Since the importance of inertial forces in interferometry increases with increasing particle mass, passive and active compensation measures have to be implemented in future experiments.

Q 4.2 Fr 11:00 Poster HU

Matter wave interferometry as a tool for the investigation of low energy collisions — ●IVAN SHERSTOV, HORST KNÖCKEL, and EBERHARD TIEMANN — Institut für Quantenoptik, Universität Hannover, Welfengarten 1, 30167 Hannover, Germany

Matter wave interferometry with light-induced beam splitters is a very powerful tool in high precision spectroscopy. Additionally, it is used to investigate collisional properties in an atomic or molecular medium like matter wave index of refraction, etc. [1-2].

The main goal of our project is to investigate the suitability and the precision of matter wave interferometry for study of weak interactions like cold collisions or weak external fields. We apply the matter wave interferometry on K₂ molecules to examine "cold" collisions in a supersonic potassium beam between atoms and molecules [3]. K₂ molecules propagate through an atomic medium and hence gain some additional phase shift due to cold collisions (corresponding to 16 K) with the atoms. By changing the medium's properties (like exciting K atoms to a higher electronic state or varying the density of the atoms in the beam) a change of the interference patterns is expected.

[1] J. Schmiedmayer, M. S. Chapman, C. R. Ekstrom, T. D. Hammond, S. T. Wehinger, and D. E. Pritchard, Phys. Rev. Lett. 74, 1043 (1995)

[2] Shannon Blanchard, Dave Civello, and Robert C. Forrey, Phys. Rev. A 67, 013604 (2003)

[3] Ch. Lisdat, M. Frank, H. Knöckel, and E. Tiemann, Appl. Phys. B 73, 99 (2001)

Q 4.3 Fr 11:00 Poster HU

Techniken zur experimentellen Umsetzung eines Sagnac-Interferometers mit kalten Atomen — ●THIJS WENDRICH, MICHAEL GILOWSKI, TOBIAS MÜLLER, CHRISTIAN JENTSCH, ERNST M. RASEL und WOLFGANG ERTMER — Institut für Quantenoptik, Universität Hannover, Welfengarten 1, 30167 Hannover

Im Projekt CASI (Cold Atom Sagnac Interferometer) [1] wird ein Atominterferometer zur Messung von Beschleunigungen und Rotationen mit höchster Auflösung verwirklicht. Wichtige Bestandteile zur Realisierung dieses neuartigen Sensors sind unter anderem stabile Atomquellen sowie ein phasenstabilisiertes Lasersystem zur kohärenten Manipulation der Atome. Die beiden Rubidiumquellen bestehen jeweils aus zwei aufeinander folgenden MOT-Stufen, aus denen die Atome in entgegengesetzte Richtungen auf parabolischen Bahnen durch das Interferometer geleitet werden. Das für die Strahlteilung bzw. Rekombination der atomaren Teilwellen vorgesehene Lasersystem besteht aus zwei phasengekoppelten Diodenlasern sowie jeweils einem Halbleiterverstärker in MOPA-Konfiguration. Unser Beitrag beleuchtet in detaillierter Weise diese zwei grundlegenden Elemente zur Verwirklichung des Interferometers.

[1] C. Jentsch, T. Müller, E.M. Rasel, and W. Ertmer, Gen.Rel.Grav. 36(10), 2197 (2004)