Announcement

**Atom Interferometry - Theory and Applications**
Dr. Albert Roura

**Description**

Atom interferometers play a central role in atomic clocks and in some of the most accurate inertial sensors to date. They are also employed in precise measurements of fundamental constants (e.g. the fine structure constant or Newton’s gravitational constant) and fundamental tests. The course will provide a detailed introduction to the theoretical aspects of atom interferometry with especial attention to light-pulse interferometers. In addition, several important applications and their main experimental aspects will be discussed.

**Content**

1. Introduction to atom interferometry and precision sensors
   - atomic clocks
   - absolute accelerometers & gravimeters
2. Basic elements of light-pulse atom interferometers (AIs)
   - Raman and Bragg scattering
   - internal-state labelling and spatially resolved detection
3. Theoretical description of the state evolution in a light-pulse AI
   - density profile at the exit ports
   - compact derivation of the general phase-shift formula including the effects of time-dependent gravity gradients, rotations, accelerations / uniform forces, vibrations, uniform magnetic fields and gradients
4. Differential measurements and common-mode noise rejection techniques
   - gravity gradient measurements
   - tests of the weak equivalence principle
5. Wave-front distortions *
   - retro-reflection scheme
   - double diffraction
   - example: gyroscope based on a light-pulse AI with cold atoms
6. Long-time interferometry for high-precision measurements
   - use of Bose-Einstein condensates
   - magnetic lenses and "delta-kick cooling"
   - microgravity platforms
7. Macroscopic quantum: phenomena: interferometry with macromolecules and nanoparticles*

(*) These topics will be covered if there is enough time.

**Additional Information**

Course type: Lecture with seminar
Attendance time: 2 hours per week
Without examination: 2 ECTS credits
Written or oral examination at the end of the course: 3 ECTS credits

**Lecturer**
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