Editorial: special issue on quantum precision measurement

Guest editor

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With the rapid development of cold atom physics and quantum optics, Quantum Precision Measurement (QPM) is becoming a more and more active research field. An extreme high measurement precision and sensitivity could be achieved by laser precision manipulation and detection of cold atoms or Ions comparing with the corresponding classical method. Precise measurements of gravity and time are very important for geophysical research and foundation physics.

In this special issue on Quantum Precision Measurement, we covered eight articles to present the latest techniques in the field of Cold Atom Interferometer and Atom Frequency Standard (or Atom Clock). Accordingly, the recent research progress of these two directions in National University of Defense Technology (NUDT), National Time Service Center (NTSC), Oxford University (OU), and Australian National University (ANU) were introduced.

Atom interferometer has been used in the fields of high precision inertial measurement as well as fundamental physics, benefitting from its high measurement sensitivity and accuracy. Examples include the measurement of gravity acceleration [1], gravity gradient[2] and rotation[3], and the testing of fine-structure constant α [4], Newtonian gravitational constant G [5], Einstein's Equivalence etc. [6]. Gravity field mapping is one of the key measurements for solid earth, ice and oceans. Here we presented two review articles to introduce Inertial measurement using atom Interferometer and Large momentum transfer (LMT) beamsplitting in atom interferometry, together with three research articles to introduce the techniques of Bragg diffraction-based cold atom interferometry gravimeter, Optical Fiber Phase Control Using Dual PID, and dressed-atom adiabatic potentials (APs) for ultracold atoms.

Time is one of the seven basic physical quantities and accurate measurement of time (or frequency) is very important in national security, transportation safety, time synchronization, navigation, communication, secure commercial transactions and fundamental physics [7-8]. The research about atom clock has exceeded half a century [9]. As one of the most promising techniques, the Strontium atom optical lattice clock was introduced here. Furthermore, NTSC-F1 Primary Frequency Standard system and New Research Trends on High-Precision Time Transfer Technology were introduced as well.

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