Message from the Guest Editor

Dear Colleagues,

Precision experiments with atomic systems provide an important avenue for testing our understanding of the laws of nature. Along with theoretical advances, they enable significant improvement in the determination of fundamental physical constants. As an example, a 13-fold improvement in the precision of the electron mass determination (relative uncertainty of 30 ppt) was obtained by interrogating a single $^{12}$C$^{5+}$ hydrogen-like ion and accounting for higher-order effects from quantum electrodynamics (QED). A direct measurement of the magnetic moment of the proton by flipping its spin in a Penning trap has now surpassed the precision of an indirect determination from the spectrum of a hydrogen maser (a 42-year-old record). The most stringent test of QED is a comparison between prediction and measurement of the anomalous magnetic moment ($g-2$) of an electron, with an independent value of the fine structure constant ($\alpha$) coming from a cold atom interferometer. Quantum interferometry of laser-cooled atoms has also provided a precise value of the Newtonian gravitational constant (G).

Dr. Joseph N. Tan

Guest Editor