Frequency comb based ultra-precise spectroscopy

Abstract: This one-hour course introduces the principles of frequency comb-based ultra-precise spectroscopy, covering its key technologies (e.g., optical frequency combs, stabilized lasers, metrological fibre links, non-linear optics), and applications in metrology, molecular physics, and fundamental tests. We will highlight how it enables sub-Hz instrumental resolution, SI-traceable measurements and the exploitation of frequency metrology methodologies (sub-Doppler spectroscopies, Ramsey interferometry …), revolutionizing precision spectroscopy. Practical examples and recent advancements will be discussed.

Lecturer: PhD at Laboratoire Charles Fabry, Institut d'Optique, France (with P. Grangier, 2005) in atomic physics/quantum optics/quantum information, on single atom trapping and manipulation in microscopic optical tweezers. Postdoc at Imperial College London (with Ed Hinds, 2005-2008) on the manipulation of ultracold atoms on atom chips with integrated optical microcavities. Upon joining CNRS as a permanent researcher in 2008, he moved to molecular physics and precise spectroscopic measurements. He is for instance currently developing new-generation molecular clocks specifically designed for precision vibrational spectroscopy of cold polyatomic molecules. This activity is at the forefront of cold molecule research and frequency metrology, and opens possibilities for using polyatomic molecules to perform tests of fundamental physics and explore the limits of the standard model, but also to address questions in astrophysics and atmospheric physics.