

*Target audience:*

This course is targeted at masters and doctoral students in physical chemistry.

*Focus:*

The course will begin with an introduction to research involving cold gas-phase molecules. The following subjects will then be covered:

- Narrow-bandwidth tuneable laser sources – pulsed and continuous.
- Nonlinear optics with continuous and pulsed laser radiation, laser frequency calibration, and laser frequency stabilisation.
- Cold polar ground state molecules and radicals: The Stark and Zeeman effects in small ground state molecules, deceleration and trapping, spectroscopy and scattering.
- Cold Rydberg atoms and molecules: Preparation of molecules in high Rydberg states, the Stark effect in high Rydberg states, deceleration and electric trapping, radiative decay processes, spectroscopy, collisions and interactions.

The course is self-contained. Those attending may find the following books of interest; however, they are *not* required for the course.

*Cold Molecules: Theory, Experiment, Applications*, R. Krems, B. Friedrich, and W. C. Stwalley (Eds.) CRC Press, (2009)

*Lasers*, A. E. Siegman, University Science Books (1986)

*Introduction to Nonlinear Optics*, G. New, Cambridge University Press (2011)