DETECTION AND SPECTROSCOPY OF POLYATOMIC MOLECULES INSIDE A CRYOGENIC BUFFER GAS CELL

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We are building a cryogenic source of polyatomic molecules that will be used for tests of fundamental physics[a,b]. The molecules are cooled by a buffer gas of 4 K He inside a copper cell mounted on the cold stage of a cryo-cooler. For the development of this source we are using 1,3,5-trioxane. Although a solid at room temperature, it has a high vapour pressure. We inject this vapour into the buffer gas cell through a room temperature tube. We probe the cooled molecules inside the cell using wavelength modulation (WM) spectroscopy, driving vibration-rotation transitions using 10.2 μm wavelength radiation from a quantum cascade laser.

I will present data from recent experiments in which we performed WM spectroscopy close to the Q-branch origin of the v_5 vibrational fundamental band. We use these spectra to probe the temperature and density of the molecules inside the cell. Most recently we have performed sub-Doppler spectroscopy, recording Lamb dips that can be used to study collision rates inside the cell.

I will discuss our plans to perform sensitive detection of a slow, cold beam of trioxane produced by this source, including a multi-pass optical assembly and cavity enhanced absorption spectroscopy.

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[a] B. Darquié *et al.*, Chirality **22**, 870-884 (2010)

[b] S.K. Tokunaga *et al.* New Journal of Physics **19**, 053006 (2017)