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Topic: Molecular spectroscopy

### **Precision spectroscopy of acetylene for fundamental science applications**

Acetylene spectra are ubiquitous for applications in astrophysics, atmospheric science and length standards. This internship proposes to develop an infrared spectrometer for broadband acetylene spectra measurements with improved precision and sensitivity. The spectrometer will exploit the optical signal at 194.4 THz delivered by the fiber link provided by the REFIMEVE network with 10-15 fractional frequency stability at one second timescale. A laser referenced to this optical signal will be amplified, shifted in frequency and exploited to probe a  $^{12}\text{C}^{2}\text{H}_2$  reference line using a differential detection.

The performances of experimental setups based on sub-Doppler and on linear spectroscopy will be characterized in terms of signal-to-noise ratio, molecular lineshape broadening and sensitivity to external perturbations. The results of the measurements will be exploited to estimate at which level and at which timescales time variation of the fundamental constants may be constrained using precision measurements of acetylene reference lines.

**Key words:** acetylene spectra, frequency standard, frequency transfer, variation of fundamental constants