Sub-Doppler ro-vibrational spectroscopy on HT

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Tests of molecular quantum electrodynamics in the hydrogen benchmark species have predominantly targeted stable isotopes such as H_2, HD, and D_2. Accurate dissociation energy measurements [1] have shown remarkable agreement with theoretical predictions [2,3]. While various cavity-enhanced techniques have been employed to measure vibrational splittings, particularly in HD [4,5], these endeavors have encountered challenges due to dispersive line shapes with multiple interpretations [6,7], restricting the precision of determining molecular vibrational level splittings. However, comparisons of numerous P and R lines have enabled the determination of highly accurate rotational level splittings [7].

Incorporating tritium-containing isotopologues in QED tests of hydrogen species provides new perspectives and deepens our understanding of these systems. Coherent Anti-Stokes Raman spectroscopy (CARS) has recently been utilized to measure vibrational splitting in T_2, HT, and DT [8], albeit with an accuracy limited to a few MHz. We aim to significantly enhance the accuracy by employing our developed NICE-OHMS technology to measure the HT overtone spectrum. We have developed a specialized setup for HT spectroscopy under radiation safety conditions. Loading and handling the HT gas is done by employing an non-evaporable getter (Fig. 1). We anticipate presenting initial results from this novel setup at the upcoming meeting.

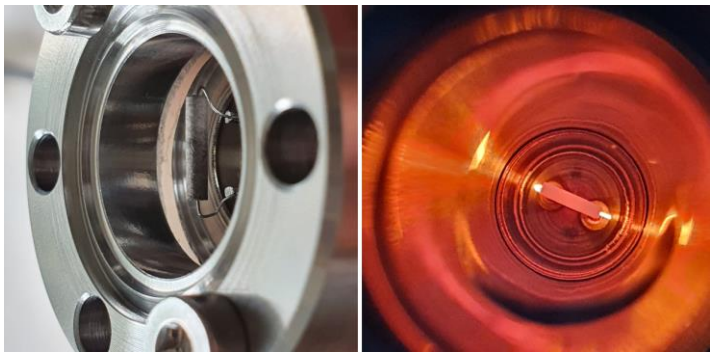

Figure 1. Left-side: Non-evaporable getter for tritium handling and loading.
Right-side: Thermal image of the getter during heating and gas loading (900 °C).

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