

## **H<sub>2</sub> clumped isotope measurements at natural isotopic abundances**

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Natural molecular hydrogen (H<sub>2</sub>) has three stable isotopologues; HH, HD and DD. At random distribution, the abundance of the so-called “clumped” molecules (DD) is directly related to the D/H ratio. The clumped anomaly ( $\Delta DD$ ) is a measure of the difference between the actual D distribution among HD and DD molecules, and the random distribution.

The  $\Delta DD$  anomaly is independent from the classical isotopic signature  $\delta D$ , and it is thus interesting as a potential new tracer for studying processes involving H<sub>2</sub>. At thermodynamic equilibrium,  $\Delta DD$  has a strong dependence on temperature with a difference of about 200 ‰ over the 0 – 1000°C range, and with a sensitivity of about 1 ‰ per °C at ambient temperatures.

The H<sub>2</sub> clumped isotope anomaly  $\Delta DD$  has never been measured at natural isotopic abundance. We will present a method for  $\Delta DD$  analysis using the new MAT-253 Ultra instrument at IMAU. H<sub>2</sub> equilibrated at different temperatures shows a dependence on temperature as expected from theoretical calculations, which validates our method. The precision obtained for  $\Delta DD$  of 2- 6 ‰ is sufficient to observe the natural variability expected in H<sub>2</sub> of atmospheric, (micro) biologic and geologic origins.