

Contributed Talk  
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## DETECTION OF INTERSTELLAR ORTHO-D<sub>2</sub>H<sup>+</sup> WITH SOFIA

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We report on the detection of the ground-state rotational line of ortho-D<sub>2</sub>H<sup>+</sup> at 1.477 THz ( $\lambda = 203 \mu\text{m}$ ) using SOFIA/GREAT. The line is seen in absorption against the far-infrared continuum from the protostellar system IRAS 16293-2422 A/B which is embedded in the dark cloud L1689N in Ophiuchus. The detection complements our previous observations of para-H<sub>2</sub>D<sup>+</sup> and ortho-H<sub>2</sub>D<sup>+</sup> using SOFIA and APEX (Brünken et al. 2014, *Nature*, 516, 219). The observed species are confined to the cool ( $T < 20$  K) outer envelope of the protostellar core. The line ratios indicate that ortho-D<sub>2</sub>H<sup>+</sup> is more abundant than para-D<sub>2</sub>H<sup>+</sup>, for which we so far only obtained an upper limit from APEX observations, by an order of magnitude, by the same token as para-H<sub>2</sub>D<sup>+</sup> was found to be by far more abundant than ortho-H<sub>2</sub>D<sup>+</sup> in this region. Both spin ratios imply a very low ortho/para ratio for the molecular hydrogen ( $o/p\text{-H}_2 < 1/1000$ ). According to current understanding, this low  $o/p\text{-H}_2$  ratio can only be reached after a long ( $> 1$  Myr) chemical processing in molecular gas. Therefore the present ortho-D<sub>2</sub>H<sup>+</sup> observation strengthens the conclusion that the current star formation activity in IRAS 16293-2422 has been preceded by a long prestellar phase.