Spectroscopy and Dynamics of H_3^+ in the Laboratory and in Space

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The recent detections of interstellar H_3^+ in dense[1] and diffuse[2] clouds and towards the Galactic Center[3] have revealed the remarkable abundance and ubiquity of this fundamental molecular ion which has been proposed as the cornerstone of the ion-neutral reaction scheme of interstellar chemistry. Because of the low temperature of interstellar space, only two rotational levels, (J,K)=(1,0) for ortho-H_3^+ and (1,1) for para-H_3^+ are significantly populated. While thermalization between two states with different spin modifications is extremely slow for neutral molecules such as NH_3, it is rapid for ions because of efficient ion-neutral reactions. We will discuss thermalization of ortho- and para-H_3^+ based on a recent laboratory experiment[4] and its significance in the conversion between ortho- and para-H_2 in interstellar space.

References:

[1] T. R. Geballe & T. Oka, Nature **384**, 334 (1996).

[2] B. J. McCall, T. R. Geballe, K. H. Hinkle, & T. Oka, Science, in press.

[3] T. R. Geballe, B. J. McCall, K. H. Hinkle, & T. Oka, manuscript in preparation.

[4] D. Uy, M. Cordonnier, & T. Oka, Phys. Rev. Lett. **78**, 3844 (1997).

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