Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Rotational Tunneling of CH_2D_2 Monolayers on MgO(100) ANDREW HICKS, JOHN LARESE, University of Tennessee-Knoxville — Understanding the detailed nature of the interactions governing physisorption is a central topic in surface science, with wide ranging energy applications in heterogeneous catalysis, gas separation, and hydrogen storage. For systems with a strong interaction potential relative to the rotational constant of the adsorbate, adsorbed molecules are constrained to minima in the rotational potential. Adsorbed molecules may then tunnel through the rotational barrier between potential minima. Rotational tunneling spectra (RTS) are extremely sensitive to changes in the symmetry and strength of the rotational potential and are unmatched in their ability to probe the electrostatic potentials associated with adsorption sites. Furthermore, RTS can be clearly observed using inelastic neutron scattering. Building upon previous work of CH_4 on MgO (see J.Z. Larese, *Physica B*, 1998), RTS of CH_3D and CH_2D_2 are interpreted using the pocket state (PS) formalism developed by *Hüller et al.* The ground librational state of the adsorbate is split into twelve "pockets", each localized around one of twelve minima in the rotational potential. We report recent RTS of single monolayers of CH_3D and CH_2D_2 adsorbed on the MgO(100) surface using **BASIS** at the SNS at ORNL. These pioneering measurements represent the highest resolution investigation available for this (or any other) RTS. The discussion will include challenges in reconciling the transitions predicted by PS theory and the features observed in the experimental data.

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Date submitted: 19 Nov 2012 Electronic form version 1.4