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State-resolved inelastic and reactive scattering dynamics of gases with liquid surfaces BRADFORD PERKINS, ALEXANDER ZOLOT, JILA, National Institute of Standards and Technology and University of Colorado, PAUL DAGDIGIAN, Johns Hopkins University, DAVID NESBITT, JILA, National Institute of Standards and Technology and University of Colorado — Energy transfer dynamics between gas and liquid surfaces are investigated by colliding a molecular beam of CO_2 with low vapor pressure liquids in vacuum. Nascent quantum states of CO_2 are probed via direct infrared absorption of the ν_3 asymmetric stretch with a Pb-salt diode laser. The high spectral resolution ($\sim$20 MHz) of the laser provides the means to characterize the translational, rotational, vibrational, and angular distributions of the scattered CO_2. Experiments have probed an array of collision energies, incident and final scattering angles, liquids, and surface temperatures. In each case, multi-channel dynamics have been observed and characterized as trapping-desorption (TD) and impulsive scattering (IS). Rotational and translational distributions show considerable excitation above the surface temperature (T_S), while the vibrational distributions remain colder than T_S. Similar experiments have probed the HF(v,J) product from reactive scattering of fluorine atoms with a hydrocarbon surface. Both the inelastic and reactive scattering distributions are well-characterized by a two-temperature model where $T_{TD} \sim T_S$ and $T_{IS} > T_S$.

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