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Self-consistent theory of helium atom scattering by a thermally excited monolayer solid L.W. BRUCH, Dept. of Physics, Univ of Wisconsin-Madison, F.Y. HANSEN, Dept. of Chemistry, Technical University of Denmark — The inelastic scattering of a helium atom beam by an incommensurate monolayer solid of Xe/Pt(111) for incident energies in the range 4 –16 meV and monolayer temperatures of 25 – 75 K is evaluated self-consistently (SC) in the one-phonon approximation. The target is very corrugated and the final scattering state comprises strong diffraction and inelastic terms. At 50 and 75 K, the atom energy gain (phonon annihilation) processes have strength comparable to the energy loss (phonon creation) processes; there are pervasive and large departures from expectations based on weak-coupling detailed balance ratios. The SC results are compared to experimental data and to results from a simpler non-self-consistent approximation (NSC) that relies on harmonic approximations to the Debye-Waller attenuations of elastic and inelastic strengths. There are major differences in the trends seen in the SC and NSC results.

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