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A Model for Molecular Hydrogen Ground State Rotational Populations in Kinetic Plasmas DAVID FARLEY, SAMUEL COHEN, Princeton Plasma Physics Laboratory — A model has been developed to calculate the ground-state rotational populations of homonuclear diatomic molecules in kinetic gases, including the effects of electron-impact excitation, wall collisions, and gas feed rate. The equations are exact within the accuracy of the cross sections used and of the assumed equilibrating effect of wall collisions. It is found that the inflow of feed gas and equilibrating wall collisions can significantly affect the rotational distribution in competition with non-equilibrating electron-impact effects. The resulting steady-state rotational distributions are generally Boltzmann for N>2 with a rotational temperature between the wall and feed gas temperatures. The N=0,1,2 rotational level populations depend sensitively on the relative rates of electron-impact excitation versus wall collision and gas feed rates.

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