STATE-TO-STATE ROTATIONAL AND VIBRATIONAL ENERGY TRANSFERS FOLLOWING VIBRATIONAL EXCITATION OF (1010^00^0) AND (0112^00^0) IN THE GROUND ELECTRONIC STATE OF ACETYLENE

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We have examined state-to-state rotational and vibrational energy transfers for the vibrational levels (1010^00^0) and (0112^00^0) of C_2H_2 in the ground electronic state at ambient temperature. Measurements were made using a pulsed IR - UV double resonance technique. Total removal rate constants and state-to-state rotational energy transfer rate constants have been characterized for certain even-numbered rotational levels from J = 0 to 12 within the two vibrational modes. The measured state-to-state rotational energy transfer rate constants were fit to some energy-based empirical scaling and fitting laws, and the rate constants were found to be best reproduced by the statistical power-exponential gap law (PEGL). The measured rate constants were then further evaluated by a kinetic model which simulated the experimental spectra by solving simultaneous first order differential rate equations. Some rotationally-resolved vibrational energy transfer channels were also observed following excitation of (1010^00^0). The vibrational relaxation channels were found to contribute less than 30% to the total removal rate constants of the measured rotational levels for both of the studied vibrational states.