COLLISION-INDUCED ENERGY TRANSFER: APPLYING SYMMETRY RESTRICTIONS, AND THE OKA MODEL TO REORIENTATION IN CH_4

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We analyze the series of approximations and restrictions that are made in understanding and modeling pressure broadening experiments, including measurements of linewidths and shifts and of population transfer. The interpretation of and relationship between these experiments is affected by common assumptions that reduce the number of free parameters, sometimes with little physical basis. In particular, scaling laws for purely M-changing rates are often assumed rather than measured. The tensor opacity expansion of the relaxation matrix defines the symmetry-based restrictions for these rates. The Oka model, and its relationship to Born approximations, provide a physical and molecular basis for selecting dominant terms from the tensor opacity expansion. For instance, the commonly-used $\Delta M = 0$ assumption, is rejected by the Oka model in the cases where it is not forbidden by the tensor opacity expansion.

We are completing the analysis of a dataset containing double-resonance population transfer data in the ground state of CH_4. Both parallel and perpendicular relative polarizations were used for the pump and probe fields, This allows 3-level and 4-level signals to be separated into alignment and total-population components. We will report results for master equation models that test the Oka model on this system.