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Rotationally inelastic collisions of He and Ar with NaK: Theory and Experiment[1] T. J. PRICE, A. C. TOWNE, K. RICHTER, J. JONES, Lehigh University, C. FAUST, Susquehanna University, A. P. HICKMAN, J. HUENNEKENS, Lehigh University, D. TALBI, CNRS & Université de Montpellier, R. F. MALENDA, Moravian College, A. J. ROSS, P. CROZET, ILM, Univ. Lyon 1 & CNRS, R. C. FORREY, Penn State Berks — Rotationally inelastic collisions of NaK ($A\,^1\Sigma^+$) molecules with He and Ar have been studied experimentally at Lehigh and at Lyon, providing information about population and orientation transfer. Theoretical calculations are also underway. We calculated HeNaK and ArNaK potential surfaces, carried out quantum scattering calculations of population and orientation transfer, and compared the results with experiment. The theoretical results show a propensity for ΔJ = even transitions for He and for Ar, in good agreement with the measured cross sections. The calculations also determine cross sections for $JM \rightarrow J'M'$ transitions at large quantum numbers ($J \leq 45$), and we have developed a semiclassical model to address this limit. Our analysis invokes the vector model and leads to a closed form expression for the JM to $J'M'$ cross sections. The model, which is in good agreement with exact quantum calculations, predicts that the polar angle $\theta = \arccos[M/(J+\frac{1}{2})]$ is approximately conserved, in agreement with several previous calculations and qualitative arguments. For many collisions the distribution of final polar angles is approximately Lorentzian.

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