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Rotationally inelastic collisions of He and Ar with NaK: Theory and Experiment¹ T. J. PRICE, A. C. TOWNE, K. RICHTER, J. JONES, A. P. HICKMAN, J. HUENNEKENS, Lehigh University, C. FAUST, Susquehanna University, R. F. MALENDIA, Moravian College, A. J. ROSS, P. CROZET, ILM, Univ. Lyon 1 & CNRS, D. TALBI, CNRS & Université de Montpellier, R. C. FORREY, Penn State Berks — Rotationally inelastic thermal collisions of NaK $A^1\Sigma^+$ molecules with He and Ar have been studied at Lehigh and Lyon. In both laboratories, a pump laser excites a particular ro-vibrational level $A^1\Sigma^+(v, J)$. Strong transitions from the pumped (v, J) level and weaker transitions from collisionally-populated levels $(v, J' = J + \Delta J)$ occur. Ratios of line intensities yield information about population and orientation transfer. At Lyon, we also identify v changing collisions. A strong propensity for $\Delta J = \text{even}$ transitions is observed for He and Ar. Theoretical calculations are underway; we've calculated He-NaK and Ar-NaK potential surfaces using GAMESS and performed coupled channel scattering calculations for $JM \rightarrow J'M'$ transitions. Semiclassical formulas for the cross sections have been obtained and agree well with our quantum mechanical calculations. Using the vector model, where J precesses with polar angle θ about the z -axis, we derived the distribution of final polar angles θ' and final M' states. We identify a special case where the θ' distribution is a Lorentzian centered at θ .

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