**Title**: Study of United States Neutron Transmutation Processes

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**Abstract**: Several scaling and matching laws for neutron-transmutation (NTM) collisions have been developed and applied. These laws will provide a model description of collisional processes for use in astrophysical applications.
FINAL REPORT

Study of Excited State Energy Transfer Processes

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We have completed and published a comprehensive review\(^{(1)}\) of the theory and application of the several scaling and fitting laws for Rotationally Inelastic (RI) collisions which we developed under AFOSR support. The review will serve as a guide for allowing broader application of this approach by other members in the field.

We have shown\(^{(2)}\) that a classical limit impulsive calculation can allow analytic evaluation of the RI basis rate constant \(k_{\ell=0}\) which predicts the power-law dependence \(k_{\ell=0} = [\ell(\ell+1)]^{-\gamma}\). This provides simple theoretical support for this previously observed empirical observation which has been shown\(^{(1)}\) to give good agreement with experimental and theoretical results in a large variety of RI collision systems.

We have completed measurements and preliminary analysis\(^{(3)}\) of the relative velocity dependence of RI cross-sections in \(\text{Li}_2^*(A^1\Sigma)-\text{Xe}\). These cross-sections show an unusually strong dependence on velocity. Calculations using classical trajectory methods are presently underway to predict the experimental results, and thus gain information on the previously unknown \(\text{Li}_2^*-\text{Xe}\) interaction potential.

