Abstract Submitted
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Search for an explanation for neutralization rates of atomic ion-ion reactions.[1] THOMAS M. MILLER, JUSTIN P. WIENS, NICHOLAS S. SHUMAN, ALBERT A. VIGGIANO, Air Force Research Laboratory — We have measured well over a hundred rate coefficients k for cation-anion mutual neutralization reactions at thermal energies. For molecular ions, the k at 300 K tend not to vary more than a factor of two or three, presumably because a great many neutral states cross the incoming Coulombic potential energy curve. Atomic-atomic systems, for which there are few favorable curve crossings between the neutral and Coulombic curves, show variation of at least a factor of 60 in the measured k values at 300 K. For reactions involving the noble-gas cations, we assume that the final state is the lowest excited state of the neutral, plus the ground state of the neutralized anion, because otherwise the crossing distance R is so small that the curve-crossing probability is nil. We plotted measured k values (in cm^3/s) vs the distance R (in bohr) at which the neutral and Coulombic curves cross, the found that the data are fairly well fit by a power law for k, $10^{-4}R^{-2.8}$. The question is, is there a physical explanation for the observed dependence on R? We will discuss the data and the expectations of Landau-Zener theory.

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