

Collisional relaxation processes of super-thermal N atoms in the lower thermosphere

Yutaka Matsumi[1]; Tomoki Nakayama[2]; Kenshi Takahashi[3]

[1] STE Lab., Nagoya Univ.; [2] Graduate School of Science, Nagoya Univ.; [3] STEL, Nagoya Univ.

<http://www.stelab.nagoya-u.ac.jp/ste-www1/div1/matsumi/>

Translational relaxation of suprathermal N(4S) in collisions with N₂, O₂, He and Ar, which is relevant to nitric oxide formation in the thermosphere, has been studied experimentally. The suprathermal N(4S) atoms which have an average translational energy of 0.93 ± 0.10 eV (21.4 ± 2.2 kcal mol⁻¹) in the laboratory frame were produced by 193 nm photolysis of NO₂. Doppler profiles of the N(4S) atoms were recorded by laser-induced fluorescence detection of N(4S) around 120.07 nm, from which the average kinetic energy of the N(4S) atoms were obtained as a function of thermalization time. Monte-Carlo calculations employing an elastic hard-sphere collision model have been performed to estimate the hard-sphere collision radii and thermalization cross sections. The thermalization cross sections, which reproduced the experimental results, were (3.2 ± 0.4) , (2.8 ± 0.4) , (1.8 ± 0.2) and (2.3 ± 0.2) in unit of 10^{-15} cm² for N(4S)+N₂, O₂, He and Ar, respectively.