Abstract Submitted
for the GEC11 Meeting of
The American Physical Society

Spatiotemporal measurement of translational and vibrational temperatures after pulsed corona discharge using laser spectroscopy RYO ONO, YOSHIYUKI TERAMOTO, YUSUKE NAKAGAWA, ATSUSHI KOMURO, TETSUJI ODA, The University of Tokyo — Translational and vibrational temperatures are measured in pulsed corona discharge using spatiotemporally resolved laser-induced fluorescence (LIF) and coherent anti-Stokes Raman scattering (CARS). The discharge occurs in a 13-mm point-to-plane gap with pulsed voltage of approximately 30 kV. Immediately after the discharge pulse, the vibrational temperatures of N2(v) and O2(v), Tv, are much higher than the translational temperature, Tt. Then, after the discharge pulse, Tv decreases with time, and the energy released from the vibrational relaxation increases Tt. This vibration-to-translation (V-T) energy transfer is observed; Tv and Tt change by hundreds to a thousand K after the discharge pulse with time constants of 1 us to 1 ms. It is shown that the V-T rate is remarkably increased when the ambient air is humidified. It is caused by extremely rapid V-T process of H2O-H2O system. In addition, V-T acceleration of O2(v) by O atoms due to rapid V-T rate of O2(v)-O system is also measured. The spatial profile of Tv shows that Tv decreases with increasing distance from the tip of needle electrode. It indicates that Tv, and the resulting Tt, are higher in the secondary streamer channel than in the primary streamer channel.

Ryo Ono
The University of Tokyo

Date submitted: 07 Jul 2011 Electronic form version 1.4