AU Peverall, R, Rosen, S, Peterson, JR, Larsson, M, Al-Khalili, A, Vikor, L, Semaniak, J, Bobbenkamp, R, Le Padellec, A, Maurellis, AN, van der Zande, WJ
TI Dissociative recombination and excitation of O-2(+): Cross sections, product yields and implications for studies of ionospheric airglows
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AB We present experimental data on the dissociative recombination (DR) and the dissociative excitation (DE) of O-2(+) in its electronic and vibrational ground state using a heavy ion storage ring. The absolute DR cross section has been determined over an electron collision energy range from 1 meV to 3 eV. The thermal DR rate coefficient is derived; alpha (T-e)=2.4x10(-7)(300/T-e)(0.70 +/-0.01) cm(3) s(-1), for T > 200 K. The threshold for DE was observed near its energetic threshold of 6.7 eV. The DE cross section curve has a maximum of 3x10(-16) cm(2) near 15 eV. We have determined the branching fractions to the different dissociation limits and present atomic quantum yields for the DR process between 0 to 300 meV collision energy. The quantum yield of O(D-1) is found to be 1.17 +/-0.05, largely independent of the electron energy. Arguments are presented that the branching fraction to O(P-3)+O(S-1) is negligible. The branching fraction to the O(S-1)+O(D-1) is smaller than 0.06 and varies strongly as a function of collision energy. The O(S-1) quantum yield is a strong function of electron temperature. Hence, the relative strength of the green, O(S-1), and the red, O(D-1), airglows may be used as a measure of the electron temperature of the upper atmosphere. A qualitative explanation is given of the consequences of nonadiabatic interactions in the dissociation step of the DR process. (C) 2001 American Institute of Physics.
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