



33rd SUMMER SCHOOL AND
INTERNATIONAL SYMPOSIUM ON
THE PHYSICS OF IONIZED GASES

August 25-28, 2026
Belgrade, Serbia

BOOK OF ABSTRACTS

Editors

Dragana Marić · Saša Dujko · Sanja Tošić
Jelena Marjanović · Bratislav Obradović



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STUDIES OF AUTOIONIZING STATES IN MOLECULAR NITROGEN AT 302.25 eV OF ELECTRON INCIDENT ENERGY

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We study autoionizing states in N_2 by using a high-resolution hemispherical analyzer equipped with 7 channeltrons and non-monochromatic electron beam with high electron current. The apparatus has been used in the past in studies of autoionizing states in He, Ne, Ar, Kr and Xe (Jureta *et al.* 2016; Marinković *et al.* 2026) at low and high incident electron energies. We noticed very low signal to background ratio in N_2 in comparison with measurements in atoms.

The molecular nitrogen (N_2) has been a subject of investigation since the inception of atomic and molecular physics. Given its biological significance and its prominence as a major constituent of the Earth's atmosphere, it has been studied extensively through both experimental and theoretical approaches. All research until 1977 has been summarized in review by Lofthus and Krupenie. In new generation of synchrotron experiments, Yenchu *et al.* (2014) studied N_2 in the photon energy region 15.0 – 52.7 eV. They applied threshold photoelectron and photoion spectroscopy technique with high resolution.

The analyzer operates at pass energy mode of 1 eV with defined retarding ratio and defined magnification determined by the two stage 11 elements lens system. The background pressure in the vacuum chamber was 5×10^{-8} mbar, while the working pressure with nitrogen was 2.2×10^{-6} mbar. The accumulation time was 2×15 min for the spectrum in Fig. 1. The kinetic energy scale has been calibrated via the energy $3s3p^63d(^1D)$ state at 11.72 eV. Calibration of the incident electron energy scale was performed using the elastic scattering channel, with an energy resolution characterized by a FWHM of approximately 0.80 eV.

Features in the 1.6–6.1 eV energy range were assigned by comparing their energy separations with the vibrational spacings of the ionic states to which they decay. The binding energy (BE) of each state was calculated as the sum of the measured kinetic energy (KE) and the ionization potential of the corresponding ionic state.

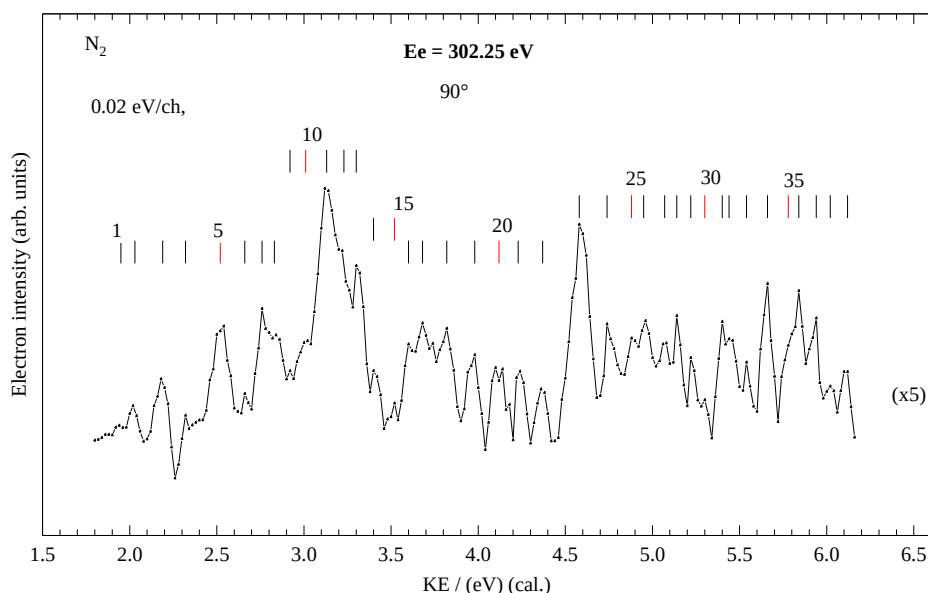


Figure 1: Autoionizing spectrum of N_2 taken at electron incident energy of 302.25 eV, kinetic energy region 1.6 to 6.1 eV and ejection angle of 90° . The spectrum is presented in linear subtraction mode with energy step of 0.020 eV/ch and a smooth mode of 3 points due to large number of closely spaced features.

We identified pairs of features that result from the decay from the ground $X^2\Sigma_g^+$ state of N_2^+ as well as Rydberg state ($v'=n$, $v''=0$) of the $B^2\Sigma_u^+$ ion state.

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