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ON THE 455.254 nm N II SPECTRAL LINE STARK WIDTH. PRESENT STATUS

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1. INTRODUCTION

Existence of the singly ionized nitrogen (N II) spectral lines in a great number of various star spectra make them interesting for diagnostic purposes. A number of the papers (Day and Griem 1965; Berg *et al.* 1967; Jalufka and Craig 1970; Purcell and Barnard 1984; Pittman and Konjević 1986) deals with the Stark width measurements of the 455.254 nm N II spectral line that belong to 3d-4f transition (multiplet No. 58). The existing experimental values lie between 18 000 K and 36 000 K electron temperature and show mutually scatter up to the factor 5. No theoretical Stark FWHM (full-width at half intensity maximum, w) calculations exist for this transition, to the knowledge of the authors (Fuhr and Lesage 1993, and references therein).

The aim of this work is to extend the knowledge of the Stark FWHM of the 455.254 nm spectral line up to 54 000 K electron temperature.

2. EXPERIMENT

The modified version of the linear low pressure pulsed arc (Djeniže *et al.* 1990; Djeniže *et al.* 1998; Milosavljević and Djeniže 1998) has been used as a plasma source. A pulsed discharges driven in a quartz discharge tube of 5 mm inner diameter and has 6.2 cm effective plasma length. The tube has end-on quartz windows. On the opposite side of the electrodes (Fig. 1 in Djeniže *et al.* 1998) the glass tube was expanded in order to reduce erosion of the glass wall and also sputtering of the electrode material onto the quartz windows. The working gas was nitrogen and oxygen mixture (83% N_2 + 17% O_2) at 70 Pa filling pressure in flowing regime. Spectroscopic observation of isolated spectral line was made end-on along the axis of the discharge tube. A capacitor of 14 μF was charged up to 3.0 kV. The line profile was recorded by a shot-by-shot technique following the procedure described earlier (Djeniže *et al.* 1990). The photomultiplier signal was digitized using oscilloscope, interfaced to a computer. A standard deconvolution procedure (Davies and Vaughan 1963) was used. The deconvolution procedure was computerized using the least square algorithm. The Stark width was measured with $\pm$15% error. The plasma parameters were determined using standard diagnostics methods. The electron temperature was determined from the ratios of the relative intensities of the 348.49 nm NIV to 393.85 nm N III and the previous N III to 399.50 nm N II spectral line, assuming the existence of LTE, with an estimated of ±12% error. All the necessary atomic parameters were taken from Wiese *et al.* (1966). The electron density decay was measured using a well-know single wavelength He-Ne laser interferometer for the 632.8 nm transition with an estimated error of ±7%.

3. RESULT AND DISCUSSION

The observed Stark FWHM of the 455.254 nm N II spectral line is 0.256 nm ±15% at T= 54 000 K electron temperature and $N = 2.8 \times 10^{23}$ m^{-3} electron density. Experimental Stark FWHM (taken from various papers and our measured value) dependence on the electron temperature, at electron density of $N = 1 \times 10^{23}$ m^{-3}, is presented graphically in Fig. 1.

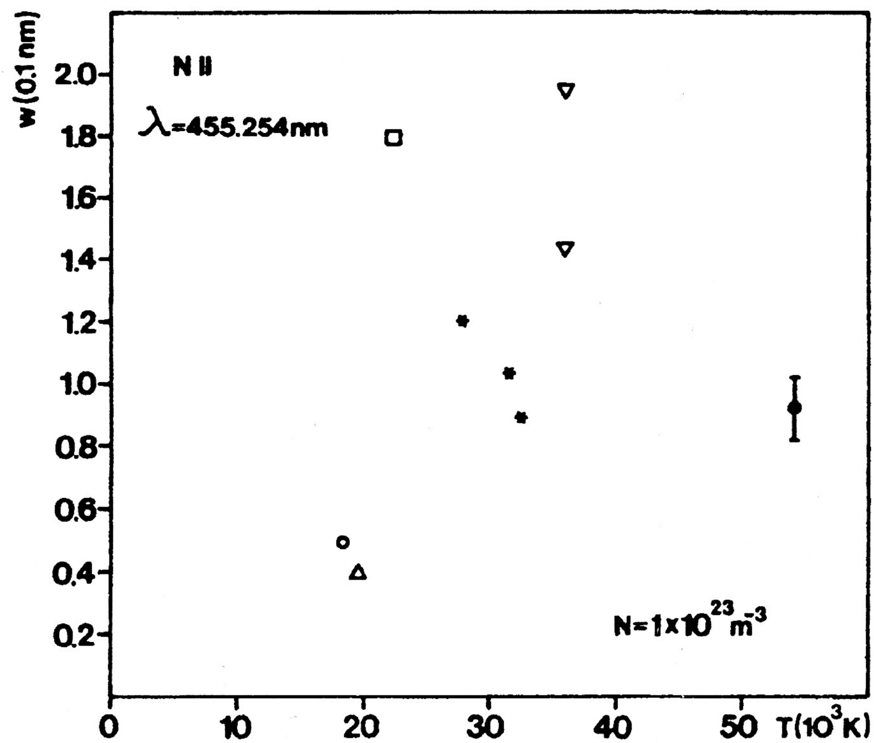

Fig. 1. Measured Stark FWHM vs electron temperature: △, Day and Griem (1965); □, Berg *et al.* (1967); ○, Jalufka and Craig (1970); ▽, Purcell and Barnard (1984); ∗, Pittman and Konjević (1986); •, this work. The error bar includes the width and electron density uncertainties.

It is evident that the existing experimental results show mutually scatter. Berg *et al.* (1967) and Purcell and Barnard (1984) have measured the highest Stark FWHM values in comparison to the results of other authors. Our new Stark FWHM value at 54 000 K electron temperature follows the trend estimated by the results of Pittman and Konjević (1986). Results from Day and Griem (1965) and Jaulfka and Craig (1970), at about 20 000 K electron temperature, lie under other experimental data. Theoretical calculations of the Stark FWHM value of the 455.254 nm N II spectral line would be helpful.

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