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MEASURED STARK WIDTH OF THE 324.75 nm Cu I RESONANCE SPECTRAL LINE

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Abstract. Stark width of the 324.75 nm CuI resonance spectral line have been measured in a linear pulsed arc plasma, superimposed to the glow discharge positive column plasma in argon-helium mixture. Copper atoms have been released as impurities by sputtering from a glow discharge copper electrode separated from the optical axis.

1. INTRODUCTION

CuI resonance spectral lines belong to the group of most intensive lines (Zaidel *et al.*, 1977). Because of that a knowledge of their characteristics is important for diagnostics of astrophysical and various plasmas created in laboratory in which copper exists as impurity. To the knowledge of the authors (Fuhr and Lesage, 1993) no experimental Stark widths data exist for the CuI resonance lines. In this work we present measured Stark FWHM (full-width at half maximum intensity) (w_m) values of the 324.75 nm CuI resonance spectral line at 17 000 K electron temperature in the argon-helium plasma.

2. PLASMA SOURCE AND PROCEDURE

A reliable plasma source has been constructed with a repetitive discharge superimposed to the continuous glow discharge. The Pyrex discharge tube is shown shematically in Fig. 1 in Djeniže *et al.* (1995). The glow discharge was driven between water-cooled copper electrodes on 50 mA circuit current in argon-helium mixture at 130 Pa filling pressure in flowing regime. Copper atoms have been released as impurities by sputtering from a copper electrode. The homogenous positive-column plasma was located in the linear part of the discharge tube (i. d 5 mm). This part was sealed with quartz windows. Two auxiliary ring-shaped electrodes were positioned along the optical axis of the glow discharge positive column plasma, 80 mm apart from each other. They were used to drive the pulsed discharge from condenser of 80 μF charged up to 1.2 kV. Investigated CuI spectral line was well isolated from other spectral lines emitted by this plasma. The spectroscopic observations were made end-on, along the

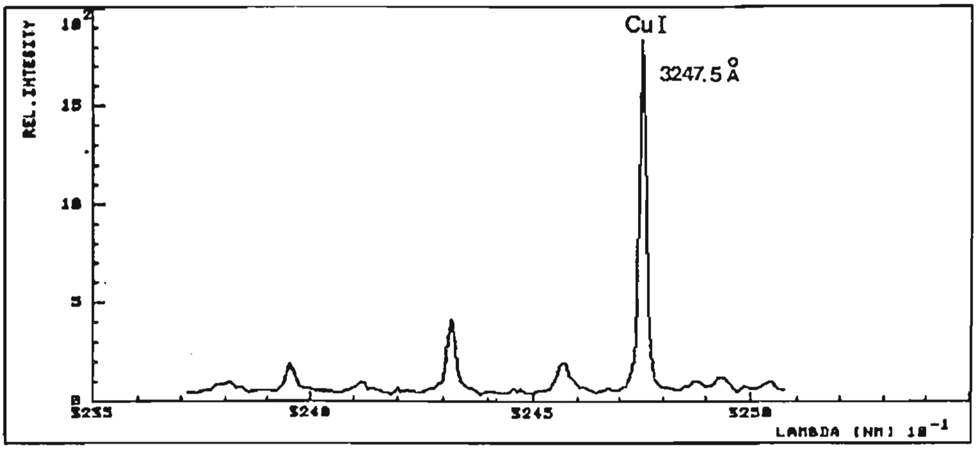

Fig. 1. The recorded spectrum with the CuI resonance spectral line.

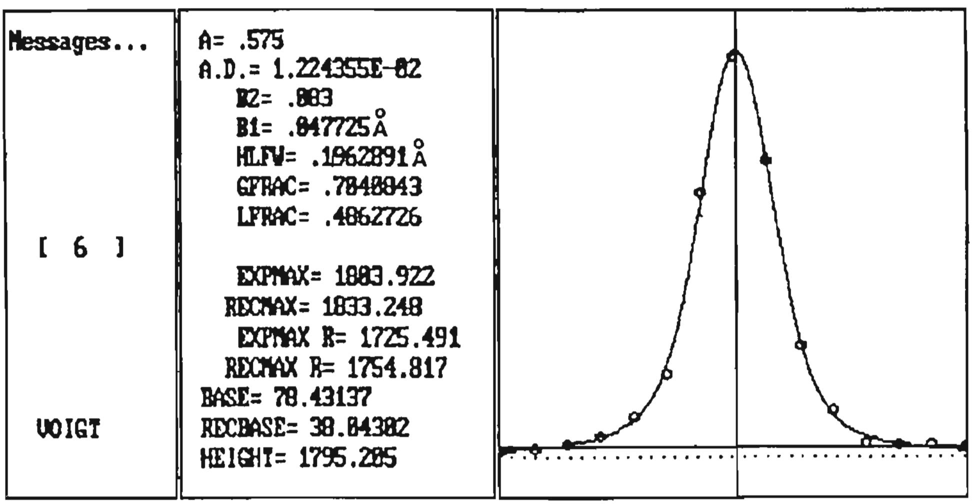

Fig. 2. CuI line profile, o-experimental points and (—) fitted Voigt profile.

axis of the discharge tube. Scanning of the spectral line profile was done using a shot-to-shot technique described elsewhere (Djeniže *et al.*, 1991).

The photomultiplier signal was digitized using digital scope interfaced to a computer. A sample output, as example, is shown in Fig. 1. The measured profil was of a Voigt type. The standard deconvolution procedure (Davies and Vaughan, 1963) was computerized using the least square algoritm. A sample output is shown in Fig. 2. The estimated error of the obtained Stark FWHM was within ±22% caused dominantly by the relatively small contribution of the Lorentz fraction to the Voigt profile.

Parameters of the pulsed plasma were determined by a standard diagnostic method. Electron temperature (T) of 17 000 K was found from the ratio of relative intensities of ArII 500.9 nm and ArI 696.5 nm spectral lines assuming the existence of the LTE within $\pm 15\%$ accuracy. The necessary atomic parameters were taken from Wiese *et al.* (1969). The electron density (N) decay was found by a single wavelength laser interferometry (Ashby *et al.*, 1965) using 632.8 nm He-Ne laser line. The maximal electron density on $6.6 \cdot 10^{22} \mathrm{m}^{-3}$ was obtained within $\pm 8\%$ accuracy.

3. RESULTS

The measured w_m value at electron temperature of 17 000 K and electron density of $6.6 \cdot 10^{22} \mathrm{m}^{-3}$ was 0.0095 nm.

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