

Mean lifetime measurements of F II and F III levels using beam-foil technique

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MS received 14 October 1997

Abstract. Beam-foil spectrum of fluorine was recorded in the wavelength region of 2000–4500 Å using F⁺ ion beams of energies ranging from 216 to 296 KeV. Some of the spectral lines of fluorine observed during the present investigation are hitherto unknown. Mean lifetimes of a few of the excited levels of F II and F III are reported for the first time.

Keywords. Beam-foil spectroscopy; fluorine; lifetimes.

PACS Nos 32.70; 34.50

1. Introduction

The earliest published results on the lifetimes of the energy levels of fluorine were by Kaselevskii and Trukhan [1]. They reported f -values for lines from F II–F V in the wavelength region 2450–3450 Å. The results were based on experiments carried out in emission using a pulsed capillary discharge source and photographic detection. Due to the uncertainty in measuring line intensities, particle densities and temperature, their estimated f -values were in error by 35–40%. Kurucz and Peytremann [2] have evaluated semiempirical gf -values for a few fluorine transitions. Smith and Wiese [3] have studied the transitions that are isoelectronic with fluorine but they could not establish any trend for f -values. Pinnington *et al* [4,5] have carried out beam-foil measurements of lifetimes of several transitions belonging to F II–F IV in the wavelength region of 2100–4500 Å. The authors evaluated the lifetimes by correcting the effects of cascade repopulation using ANDC method and theoretically calculated the corresponding lifetimes under the Coulomb approximation. However the theoretical and the experimental data available till date differ very much from each other. In the present studies the beam-foil spectrum of singly and doubly ionized fluorine was reinvestigated in the wavelength region 2200–4500 Å and the mean lifetime measurements of quite a number of energy levels were carried out for the first time. The details of the results are discussed.