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CALCULATION OF PASCHEN LINES FOR ASTROPHYSICAL AND FUSION PLASMAS

I. Hannachi[1], A. Calisti[2], J. Rosato[2], Y. Marandet[2] and R. Stamm[2]

[1] *University of Batna 1, LRPRIM, 05000 Batna, Algeria*
[2] *Aix-Marseille Université, CNRS, PIIM UMR 7345, Campus de Saint-Jérôme, Case 322, F-13397 Marseille Cedex 20, France*

E-mail: ibtissam.hannachi@univ-batna.dz

Paschen lines allow interesting spectroscopic diagnostics in the near infrared region of astrophysical, laboratory and fusion plasmas. The shapes of Paschen lines are mainly influenced by Stark broadening, which increases with the principal quantum number. In astrophysics, the Paschen gamma (Pγ) and Paschen delta (Pδ) lines are commonly employed as diagnostic tools in standard stars of spectral types B to M, serving as benchmark for validating and refining model stellar atmospheres [1]. In tokamaks, particularly in the JET divertor, Paschen lines help diagnose the plasma properties [2]. We first present Paschen line calculated with the line shape code PPP [3], which retains ion dynamics effects with the frequency fluctuation model [4]. The main broadening mechanisms affecting the Paschen lines will be discussed for plasma densities between 10^{19} and 10^{21} m^{-3}. We are also currently interested in diagnosing fusion plasmas through the first Paschen lines of hydrogen in the presence of an oscillating electric field. The Paschen beta (Pβ) line of hydrogen in the experimental conditions of the spherical tokamak QUEST in Kyushu (Japan) has been measured in the presence of an electron cyclotron heating microwave beam. Additionally, the Pβ line of deuterium will be measured on the Heliotron J at Kyoto University in the presence of a radio frequency wave. In the observation region, the plasma has a temperature on the order of 100 eV and an electron density of 5x10^{18} m^{-3}. Line shapes obtained by a numerical simulation of the plasma microfield, and a numerical integration of the emitter Schrödinger equation [4], will be presented for a future comparison with the line shapes measured in the fusion devices.

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