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Stark Broadening of the Neutial Helium Line 3965 Å

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We calculate the Stark broadening of the allowed component of the He I 3965 Å (4P-2S) assuming that it is an isolated line. A convergent method is used to estimate the electronic contribution. To take into account the effect of the ions we use the approach developed by Griem *et al.* Our calculations are compared with the experimental and theoretical results of Pilon and Barnard and with the experimental results of Diatta.

Nós calculamos o alargamento Stark da componente permitida do He I de 3956 Å (4P→2S) supondo que ela é uma linha isolada. Um método convergente é usado para obter a contribuição eletrônica. Para levar em conta o efeito dos íons nós usamos a teoria desenvolvida por Griem et *al.* Nossos cálculos são comparados com os resultados teóricos e experimentais de Pilon e Barnard e com os resultados experimentais de Diatta.

In a recent paper, Pilon and Barnard[1] have studied experimentally and theoretically the Stark broadened profile of He I 3965 Å (4P-2S). In the experimental conditions of Pilon and Barnard the electron densities N are in the range of 1.0×10^{16} to 1.9×10^{16} cm^{-3} and the temperature is about 1.5 eV.

They verified that the forbidden components are very weak and the allowed component can be considered as an isolated line, only for densities $N \lesssim 1.0 \times 10^{16}$ cm^{-3}.

To calculate the complete profile, composed by allowed and forbidden components, they have used an approach developed by Barnard, Cooper and Shamey[2]. According to them, the ion broadening is treated in a quasistatic approximation and the electron broadening of the overlapping Stark components in an impact approximation.

They found that the observed allowed line is in good agreement with their calculations but that the forbidden components are much wider than estimated.

Our intention in this paper is to analyse to what extent the width of the allowed component can be calculated assuming that it is an isolated line. In order to see this, we compare our calculations with the experimental results of Pilon and Barnard[1] and Diatta[3]. We compare also our results with the theoretical predictions of Pilon and Barnard[1], where overlapping effects between allowed and forbidden lines are taken into account.

According to Griem[4] and Griem *et al.*[5], the full width ω at half maximum intensity of an isolated line is given by:

$$\omega = \omega_e \times \left[1 + 1.75\,\alpha\,(1 - 0.75\,R)\right] \qquad (1)$$

where ω_e is the full width due to electron impacts and the parameters α and R are defined elsewhere[4].

In a preceding paper, Bassalo, Cattani and Walder[6] have applied the convergent method to calculate the widths and shifts, produced by electronic collisions, of some isolated lines of neutral Helium. They verified that, within the experimental errors, the agreement between the theoretical and experimental results is good for the widths and reasonable for the shifts.

In the present work we have used the convergent approach of Bassalo *et al.*[6] to calculate the electronic widths w_e.

In Figure 1 are shown the experimental results of Pilon and Barnard[1] and of Diatta[3] and the theoretical predictions of Pilon and Barnard[1] and those obtained with equation 1, taking into account the convergent approach to obtain ω_e.

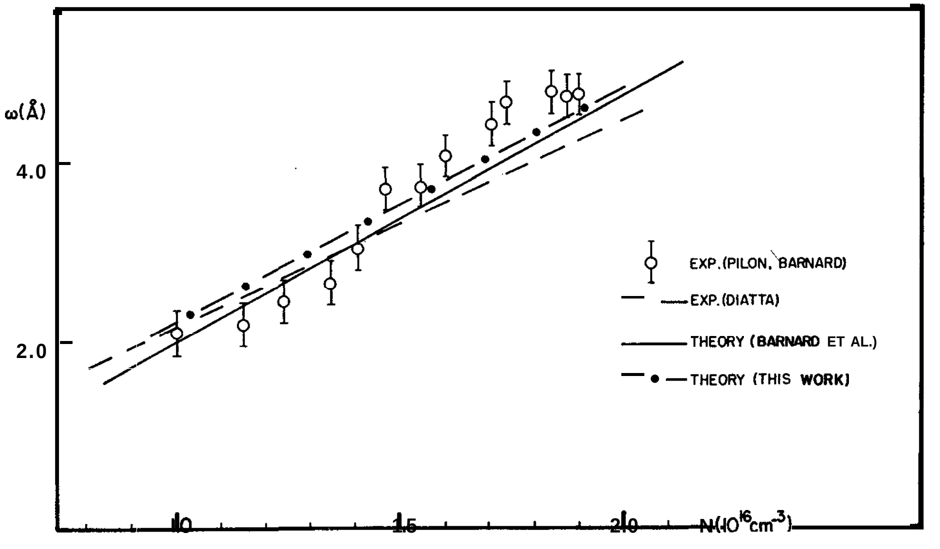

Fig.1 - Experimental and theoretical results for the full width at half--maximum intensity as a function of the electron density.

From Figure 1 we see that there is a good agreement between the theoretical and experimental results of Pilon and Barnard and the predictions of the convergent theory. The agreement with the experimental results of Diatta is reasonable.

This means, according to the convergent estimates, that the allowed component of the He I 3965 Å can be considered, satisfactorily, as an isolated line in the analysed conditions.

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