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ON THE VARIATION OF STARK LINE SHIFTS WITHIN A SUPERMULTIPLET

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Abstract. In order to find out if regularities and systematic trends found to be apparent among experimental Stark line shifts allow the accurate interpolation of new data and critical evaluation of experimental results, the exceptions to the established regularities have been analysed on the basis of critical reviews of experimental data, and reasons for this situation have been discussed.

1. INTRODUCTION

Wiese and Konjević (1982) carried out a study of regularities in Stark widths of non-hydrogenic lines and they found similarities (see as well references in Wiese and Konjević, 1982 and Dimitrijević, 1982) of line widths within multiplets, supermultiplets, transition arrays and for analogous transitions of homologous atoms and ions. They found as well systematic trends along spectral series. Dimitrijević (1982) analysed the exceptions of the established regularities and he found that the reasons for such exceptions may be divided in two categories: (i) irregular atomic energy level structure and (ii) inadequacy of the used model of the emitter structure. In 1992, Wiese and Konjević published results of similar investigations of experimental Stark line shifts and they showed on the numerous examples the same regularities and systematic trends. The aim of this investigation is to analyze the exceptions of the established regularities and systematic trends for Stark line shifts.

2. RESULTS AND DISCUSSION

In order to examin if regularities and systematic trends found to be apparent among experimental Stark line shifts allow the accurate interpolation of new data and critical evaluation of experimental results, as well as the check of the consistency of a theoretical data set, the exceptions to the established regularities have been analysed on the basis of critical reviews of experimental data (Konjević and Roberts, 1976; Konjević and Wiese, 1976; Konjević, Dimitrijević, Wiese 1984ab; Konjević and Wiese, 1990) and reasons for this situation have been discussed.

The complete analysis will be published elsewhere. Here, we present two such examples.

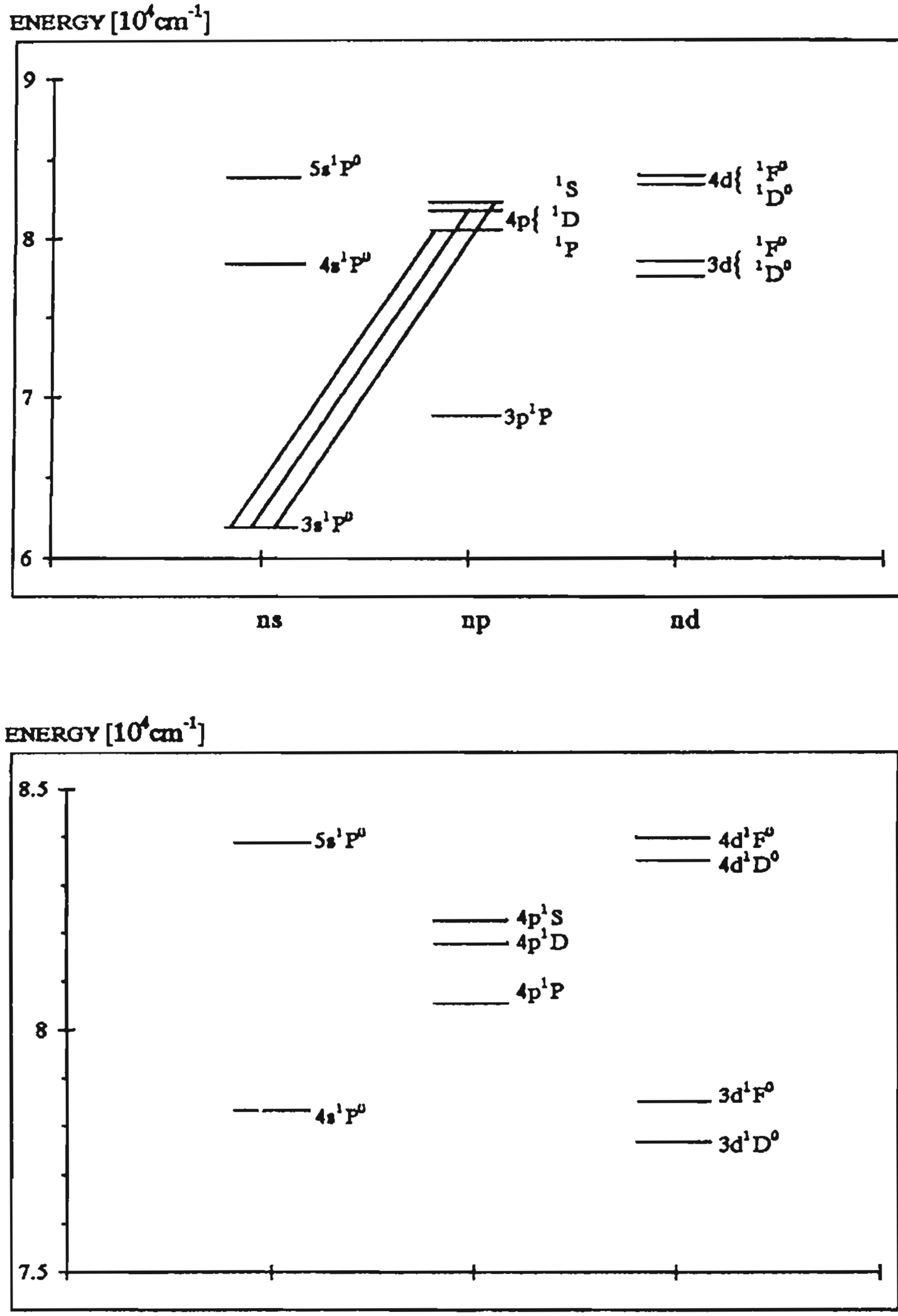

Fig. 1. Partial Grotrian diagram for C I (2p3s-2p($^2P^o$)4p)

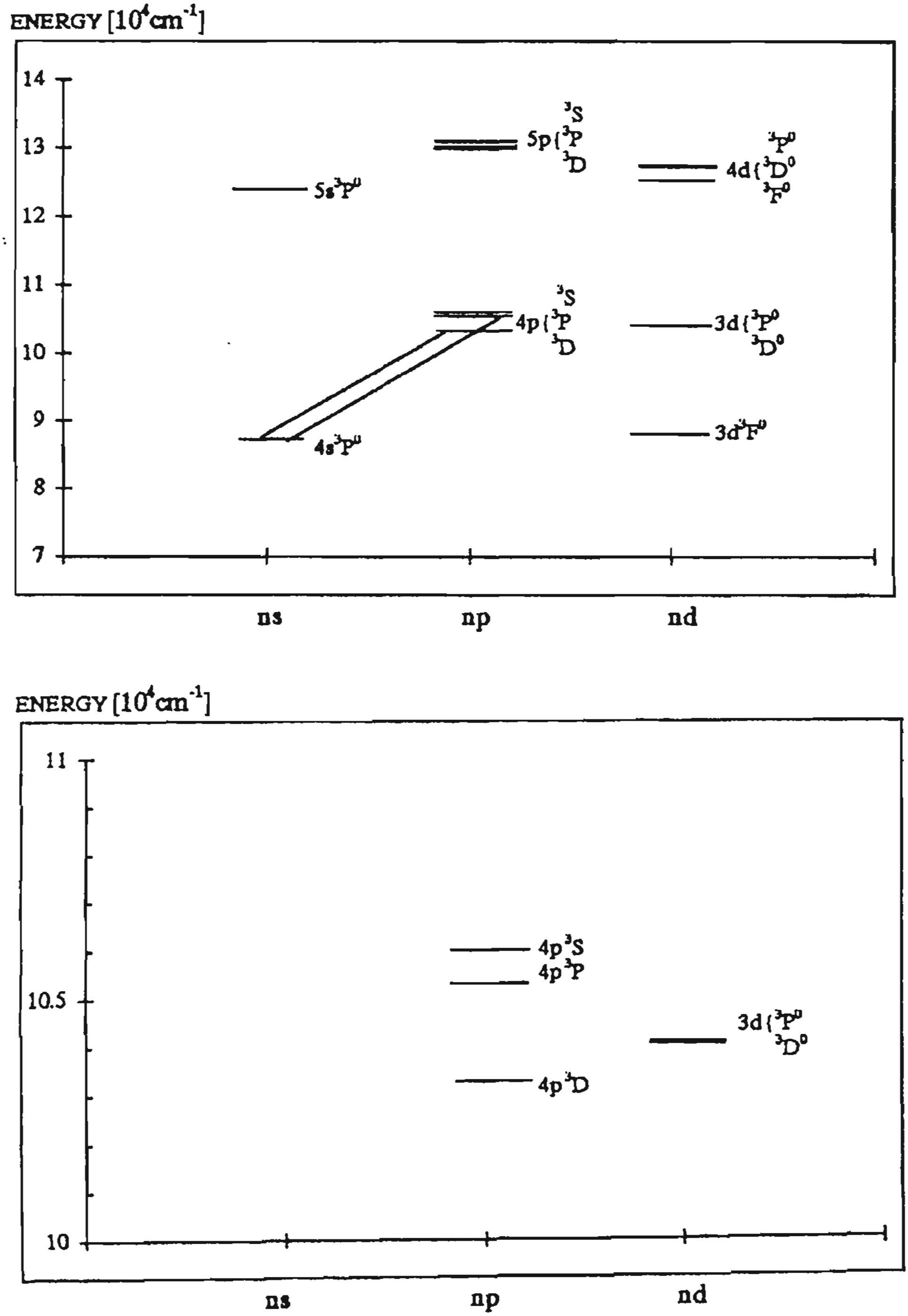

Fig. 1. Partial Grotrian diagram for P II (3p4s-3p($^2P^o$)4p)

The example of Stark line shifts from C I 3s - 4p (singlets) supermultiplet, illustrates the case when the energy gap between upper atomic energy levels for particular members of a supermultiplet is equal or comparable to the energy gap to perturbing levels. One can see that the difference of shift values in the examined example is one order of magnitude due to the different influence of perturbing 4d levels,

The example of Stark line shifts from P II 4s - 4p (triplets) supermultiplet, illustrates the case when the most important perturbing levels (3d levels in the examined case), are embeded between the energy levels (4p levels in the examined case) of upper/lower terms of the supermultiplet. One can see that in such a case even the sign of shift is different for different members of the examined supermultiplet.

Table 1

This table shows experimental (Miller and Bengston, 1970) Stark line shifts for C I 3s - 4p supermultiplet (singlets) for a perturber density of 10^{17} cm^{-3} and a temperature of 11 000 K.

Transition	j_i	j_f	λ(Å)	Shift(Å)	Accuracy
$3s^1P^o$-$4p^1P$	1	1	5380.3	0.3	C
$3s^1P^o$-$4p^1D$	2	1	5052.1	2.2	C
$3s^1P^o$-$4p^1S$	0	1	4932.0	3.0	C

Table 2

This table shows experimental (Purić et al., 1985) Stark line shifts for P II 4s - 4p supermultiplet (triplets) for a perturber density of 10^{17} cm^{-3} and a temperature of 20 000 K.

Transition	j_i	j_f	λ(Å)	Shift(Å)	Accuracy
$4s^3P^o$-$4p^3D$	2	3	6043.12	0.35	C
$4s^3P^o$-$4p^3D$	1	2	6024.18	0.31	C
$4s^3P^o$-$4p^3D$	0	1	6034.04	0.35	C
$4s^3P^o$-$4p^3P$	2	2	5425.91	-0.46	C

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