

Fine Structure Analysis of the Configuration System of V II

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Using a linked-parameter technique of level-fitting calculations in a multiconfiguration basis, a parametric analysis of fine structure (fs) for even-parity levels of V II, involving six configurations, has been performed. This led us to exchange the assignments of two triplets, $3d^3(^2F)4s$ c 3F and $3d^4$ d 3F , reported in earlier analyses as being located at 30300 cm^{-1} and 30600 cm^{-1} , respectively. This is confirmed by experimental hyperfine structure A constants, used as fingerprints. Moreover, the current singlet $3d^24s^2$ 1D_2 position is likely too high. The $3d^34p$, $3d^35p$ and $3d^24s4p$ odd configurations of the V II spectrum have been also reanalysed and three $3d^24s4p$ triplets are assigned higher energies than previously proposed. We have determined the fine structure parameters, the largest and next largest eigenvector percentages of levels, their calculated Landé g_J -factors and predicted positions for missing experimental levels up to 100000 cm^{-1} . Furthermore for the first time hyperfine structure (HFS) parametric treatment, involving levels has been carried out. The deduced single-electron HFS parameter values are successfully checked with those obtained by means of ab initio calculations.

Config.	$3d^24s^2$		$3d^34s$		$3d^35s$	
	Fit	ab-initio	Fit	ab-initio	Fit	ab-initio
E_{av}	43799(94)	43799	19730(30)	18489	84820(42)	78881
$F^2(3d, 3d)$	62037(199)	60288	54057(66)	54104	57330(90)	55519
$F^4(3d, 3d)$	38140(271)	37703	31693(236)	33596	34978(92)	34544
$G^2(3d, ns)$			8144 (43)	8207	1339(35)	1523
ζ_{3d}	200(17)	184	156(10)	157	171(10)	161
α	50(1)		50(1)			
β	-130(19)		-130(19)			
T_s			4 (11)			
T_2			-45 (11)			
T_3			-239(13)			

Config.	$3d^4$		$3d^34d$		$3d^35d$	
	Fit	ab-initio	Fit	ab-initio	Fit	ab-initio
E_{av}	18687(13)	17691	89766(32)	83105	103174(351)	100986
$F^2(3d, 3d)$	48480(56)	47503	56710(118)	55559	57837 (360)	55725
$F^4(3d, 3d)$	28317(72)	29249	33302(178)	34573	32727(330)	34682
ζ_{3d}	138(9)	131	166(9)	161	166(9)	161
ζ_{nd}			11(6)	9	5(3)	4
α	50(1)		7 (1)			
β	-130(19)		-83(16)			
T_2	-45(11)					
$F^2(3d, 4d)$			4484(98)	5238	1910 (82)	1847
$F^4(3d, 4d)$			2196(99)	2230	864(39)	826
$G^0(3d, 4d)$			1923(26)	2155	717 (10)	1247
$G^2(3d, 4d)$			1551(124)	1927	610(50)	922
$G^4(3d, 4d)$			1900(86)	1449	758(34)	637

Table 1: *Fine structure parameters for even-parity levels*