TABLE I. Fine-structure separations of the $4s^24p$ ground configuration in the gallium isoelectronic sequence (in cm^{-1}).

Ion	NBS Obs. (uncert.)	Fit	Fit-obs.	PLT Obs. (uncert.)	Fit-obs.
$_{31}Ga$	826[a,b]	c			
$_{32}Ge^{1+}$	1 767[a,d]	(1 665)			
$_{33}As^{2+}$	2 940[a,e]	(2 917)			
$_{34}Se^{3+}$	4 376[f]	4 373	−3		
$_{35}Br^{4+}$	6 089(6)[g]	6 093	4		
$_{36}Kr^{5+}$	8 108(10)[h]	8 113	5		
$_{37}Rb^{6+}$	10 468(2)[i]	10 468	0		
$_{38}Sr^{7+}$	13 186(3)[i]	13 192	6		
$_{39}Y^{8+}$	16 322(3)[i]	16 317	−5		
$_{40}Zr^{9+}$	19 886(4)[i]	19 880	−6		
$_{41}Nb^{10+}$	23 915(5)[i]	23 917	2		
$_{42}Mo^{11+}$	28 466(5)[i]	28 465	−1	28 463(2)[j]	2
$_{43}Tc^{12+}$		33 563			
$_{44}Ru^{13+}$	39 187(47)[i]	39 254	67		
$_{45}Rb^{14+}$	45 581(9)[i]	45 580	−1		
$_{46}Pd^{15+}$	52 572(9)[i]	52 585	13		
$_{47}Ag^{16+}$	60 322(9)[i]	60 316	−6	60 317(4)[j]	−1
$_{48}Cd^{17+}$		68 821			
$_{49}In^{18+}$	78 149(16)[i]	78 150	1		
$_{50}Sn^{19+}$		88 356			
$_{51}Sb^{20+}$		99 492			
$_{52}Te^{21+}$		111 614			
$_{53}I^{22+}$		124 783			
$_{54}Xe^{23+}$		139 057			
$_{55}Cs^{24+}$		154 501			
$_{56}Ba^{25+}$		171 181			

[a] Not used in fit.
[b] Reference 10.
[c] No real solution to Eq. (2) for this Z, S_0, and b.
[d] Reference 11.
[e] Reference 12.
[f] Reference 13.
[g] Reference 14.
[h] Reference 15.
[i] This work, NBS.
[j] This work, PLT.

empirical parameters S_0 and b in the linear relationship

$$S(Z)=S_0+b/[Z-S(Z)] \ . \tag{1}$$

The goodness of fit is enhanced if the Rydberg constant $\mathscr{R}$ in the hydrogenic equation that defines $S(Z)$ is replaced by an effective value

$$\mathscr{R}\rightarrow\mathscr{R}/(1+\epsilon) \ , \tag{2}$$

where ϵ is an additional fitting parameter that is introduced to empirically compensate for deviations from the one-electron picture (cf. Refs. 7 and 8), and is evaluated by optimizing the fitting of the data to Eq. (1).

Excluding the first three ionization stages in the data in Table I, we obtained the best weighted least-squares fit using a value $\epsilon=0.020$. This compares with the values 0.017 and 0.016 that were obtained for the corresponding quantities in the boron[7] and aluminum[8] sequences. A plot of S vs $1/(Z-S)$ with this value of ϵ is shown in Fig. 1. The weighted least-squares adjustment yielded the values $S_0=9.875$ and $b=114.56$. Comparing these with the fitted parameters in Ref. 8 of $S_0=10.14$ and $b=110.88$ one should note that the earlier analysis was based on only four

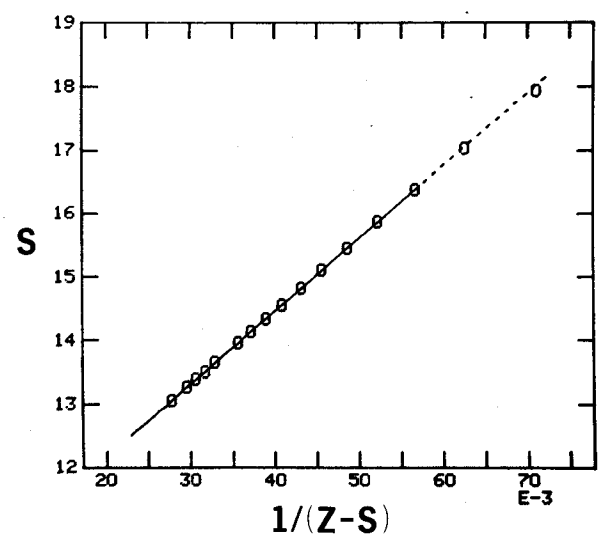

FIG. 1. Plot of the screening parameter S vs the reciprocal screened charge $Z-S$, reduced using a value $\epsilon=0.020$ in Eq. (2). Observations are denoted by (0) for $Z=32$–42, 44–47, and 49. The solid line indicates a weighted least-squares fit to Eq. (1), which becomes a dashed line in the $Z<34$ region where the points were excluded from the fitting.