CALCULATIONS ON THE SOLAR SPECTRUM FROM 1 TO 60 Å

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Over two hundred spectral line intensities between 1 and 60 Å from ions in the solar corona have been computed for electron temperatures ranging between 10^5 and 10^9 K (Mewe, 1972a). Also the continuum (ff+fb) radiation intensity has been computed. The calculations were set up to interprete soft X-ray measurements aboard the ESRO 2B satellite (IRIS): Wavelength bands 44–55 Å (experiment of Space Research Laboratory, Utrecht) and 1–3, 3–9, 6–18 Å (expt. of University College, London) (Brinkman and Shaw, 1972).

TABLE I

Comparison of computed and measured line fluxes (40–60 Å)

Ion	Wavelength (Å)	Isoel. seq.	Line Flux (10^{-3} erg cm^{-2} s^{-1})				
			[1]	[2]	[3]	[4]	[5]
C V	40.3	He	1.5	4.5	1.6	3.9	3.1
C V	40.7, 41.5	He	1.6	5.2		3.0	3.6
Si XII	40.9	Li	0.8	1.8	0.6	1.0	2.3
S X	42.6	N	3.0	6.2		1.6	1.5
Si XI	43.8	Be	5.0	9.2	0.9	2.1	3.2
Si XII	44.1	Li	2.1	6.4	1.2	3.1	~4
Si XII	45.6	Li	1.1	3.4	0.6		3.2
Si XI	46.3	Be	3.3	5.8			1.7
Si XI	49.2	Be	3.2	5.6	1.4	6.9	4.6
Fe XVI	50.4	Na	0.6	1.1		0.8	2.3
Si X	50.6	B	6.9	11.8	3.5	12.8	7.2
Si XI	52.3	Be	2.9	5.1	0.7		2.8
Fe XV	52.9	Mg	1.1	5.0	0.7	1.2	1.2
S VIII	54.1	F	0.7	1.4	0.8	1.9	1.6
Fe XVI	54.7	Na	0.25	0.5	0.8		2.4
Si IX	55.1	C	1.4	2.8			1.5
Si IX	55.3	C	4.3	8.6	2.7	10.3	3.7
S IX	56.1	O	0.9	1.8			1.3
Si X	56.8	B	3.1	5.3			1.4
Si X	57.2	B	3.1	5.3			< 1.0
Mg X	57.9	Li	0.4	0.7	1.7	2.0	3.0
Fe XIV	59.0	Al	0.6	1.5			1.4
Fe XIV	59.6	Al	1.1	2.8			1.4

[1] Computations (Harvard model) for quiet Sun.
[2] Computations (Harvard model) for quiet Sun + 10 % active regions.
[3] Rocket measurements by Manson (3. 11. 65).
[4] Rocket measurements by Tousey *et al.* (20. 9. 63).
[5] Rocket measurements by Freeman and Jones (20. 11. 69).

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The computation is an extension to the work of Landini and Monsignori Fossi (1970). Also non-resonance lines are considered, e.g., lines that are excited through forbidden transitions, and inner-shell transitions.

The gaunt correction factor in the excitation cross-section was approximated by the expression $\bar{g}(U)=A+BU^{-1}+C\ln U$, where the parameters A, B, and C were fitted to several existing theoretical or observational data (H-, He-, Li-, and Ne-like ions) or approximated by some average value (Mewe, 1972a,b); U is the electron energy relative to the excitation energy. Element abundances were mainly taken from Pottasch's and Jordan's publications, ion abundances were taken, in some cases by isoelectronic interpolation, from the work of Jordan (cf. for further references Mewe, 1972a).

For the interpretation of solar photographs taken with a zone plate camera in the wavelength region around 51 Å (rocket expt., SRL, Utrecht; Burger and Dijkstra, 1972) the strongest lines between 40 and 60 Å were computed on the basis of one-dimensional models for the electron temperature and density distributions in the average quiet and active solar corona. These models were obtained by the Harvard College Observatory group from OSO-4 spectroheliograms between 300 and 1400 Å (Noyes, 1971). The theoretical line intensities agree within a factor of two to three with several rocket measurements (Tousey *et al.*, 1965; Manson (1967), cited by Widing and Sandlin, 1968; Freeman and Jones, 1970) (cf. Table I).

References

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DISCUSSION

S. R. Pottasch: Which abundances did you use to compute the line intensities?

R. Mewe: I used the element abundances from your work and that of C. Jordan. For several less abundant elements the cosmic abundances given by C. W. Allen were used.