1 Morphology

1.1 Photosphere

Structure	Size (Mm)	Lifetime	T(K)	B (kG)	Misc.	Refs
Large Scale Unipolar	> 100	year		10^{-3}(avg)	coronal holes above some	[Pr82, Pr82, Pr82, Pr82]
Supergranules	20 - 54	1 - 2 days			$v_{convec} \sim .2$ km/s	[Pr82, Pr82, Pr82]
Granules	.7 - 1.5	10 min				[Pr82, Pr82]
Pores	.7 - 1.8	hrs - day		$2.2 \pm .2$	precede spots; no penumbra	[Zw87, Pr82, Zw87, Pr82]
Sunpots(pair) - umbra(pen) - umbral dots - penumbral filaments	sep'n:150 2–11.5(4–28) .15 - .2 $L = 6; W = .35$	days-mos 1500 s .5 - 6 hr	 3700 5700 5700	 $2.9 \pm .4$	 $I_{vis} = 10\% I_{photosph}$ $I_{vis} = I_{photosph}$ $v_{\rm Ev}$ =7 km/s; $v_{\rm pen.wv.} = 15$ km/s	[Pr82, Pr82] [Zw87, Pr82, Zw87, Pr82] [Pr82, Pr82, Pr82, Pr82] [Pr82, Pr82, Pr82, Pr82]
Plage				avg = .1	Hα & Ca K	[Ph92]
Micropores/ Magnetic knots	umbra:$\sim$.5	hr		1.5 – 2	5% area cov.; plages' field source	[Zw87, Pr82, Zw87, Pr82]
Network/Faculae	.35 - .6			1.2 - 2	"Net" on disk, "Fac" @ limb	[To97]
Filigree/Crinkle	$L = 1.8; W = .2$				clustered faculae, 'tween granules	[Pr82], p. 21
Grains	1.5	1 - 4 min	4300 - 5000		most EUV emiss.; 10% area cov.	[Pr82], p. 19
Inner Network Fields		30 min		10^{17}Mx	found within suprgrans.	[Pr82], p. 24
Magnetic knots/ Network Fields Flux Tube/"Fiber"/	.1 - .3 umbra:$\sim$ .01			1 $\sim$1.5	'tween granules	[Pr82], p. 22 [Zw87, Zw87]

1.2 Chromosphere

Structure	Size (Mm)	$\tau_{\text{life}}; \tau_{\text{var}}$	T(K)	n_e(cm^{-}3)	B (G)	Misc.	Refs
Canopy						AR(QS) $z = .75(1.6)$ Mm	[Pr82], p. 24
Spicule	$L = 15; W = .5 - 1.2$	5-10 min.	1-2 x 10^4	.3-3x10^{11}		v=25 km/s; $z < 11$ Mm; $v_{\text{rot}} \gg 0$; $\langle\theta\rangle = 20°$	[Pr82], p. 26
Fibrils/Mottles	$L = 10; W = 1$					dark in Hα; 50 % area cov.	[Pr82], p.27
Macrospicules	$W = 4 - 11$	8-45 min		10^{10}		$z_{\max} = 4 - 40$ Mm; $v = 10 - 150$ km/s	[Pr82], p.29
Network						sup'gran. bounds, in Ca II K	[Pr82], p. 26

1.3 Corona

Structure	Size (Mm)	$\tau_{\text{life}}; \tau_{\text{var}}$	T(MK)	n_e(cm^{-}3)	B	Misc.	Refs
Cor. Hole	450	mos	1 - 1.5	2 x 10^8		polar holes: $\sim$ 800 Mm	[Ph92, Ph92, Ph92, Ph92]
Helmet Streamer	$\sim R_\odot$	weeks	1.4 - 2			$v_A(c_s) \simeq$700(150)km/s	[Go97, Go97, Go97, Go97]
Prominence - QS - AR	$L = 200; W = 6$ $L = 60; W = 2$	mos days	7x10^{-3} "	$10^{10} - 10^{11}$ $> 10^{11}$	5-10 G 100 G	$z_{\max} < 50$ Mm $z_{\max} < 20$ Mm	[Pr82, Pr82, Pr82, Pr82, Pr82] "
Active Region	100 [sic]	mos		1-7 x 10^9			[Ph92, Ph92, Ph92]
X-ray Bright Pt	dia(cores) = 22(6)	8 h; mins	2–2.5	5 x 10^9	2x10^{19} Mx	Eph. Reg. in mag'gram	[Go97, all]
Loops - QS - AR - Interconn. - Post Flare - Compact Flare	20–700 10–100 20–700 10–100 5–50	sing(syst):day(mos)	1.8 10^{-2}–2.5 2–3 10^{-2}–4 < 40	.2-1x10^9 .5-5x10^9 .7x10^9 10^{11} $< 10^{12}$		outside holes " " ; join A.R.'s " "	[Pr82, Pr82, Pr82] " " " "
Polar Plumes	$W = 7$					$> 70^o$lat, only if no hel.strmrs.	[Go97, Go97]

2 Selected Spectral Lines

Ion	$\lambda(\AA)$	$\Delta\lambda$	$\log(T_{\max})$ (K)	Layer	Excit. Mech.	Notes/Instrument(s)
H I, Ly-α	1216	84	4	CH		TR;
H I, Hα	6563			PH		MLSO; Kitt/Sac; BBSO;
He II	304			TR		EIT;
He I	10830					
C IV	1550	20 [TR www pg]	5.0 [Jo69]			TR;
O IV	$\sim$ 1400		5.2			n_e; 1399.8,1401.2,1404.8,1407.4
Na D_2	5890	.8		PH–CH		
Na D_1	5896	.6		PH–CH		Mt.Wilson;
Ca II H	3968			PH–CH		
Ca II K	3934			PH–CH		MSO; Kitt/Sac; BBSO;
Ca XV	5694		6.6 [Ja80]	CO	forb [St89]	"yellow" corona
Fe I	5250			PH		Mt.Wilson;
Fe I	6302			PH		increasingly used magnetograph doublet
Fe IX/X	173	6.4 [TR www pg]	6/6.1 [Ar85]	TR		TR; EIT;
Fe X	6374		6.1 [Ar85]	CO	forb [St89]	"red" corona
Fe XII	195	6.5 [TR www pg]	6.2 [Ja77]	TR	forb	TR; EIT;
Fe XIV	5303		6.3 [Ja77]	CO	forb [St89]	"green" corona
Fe XV	284	10.7 [TR www pg]	6.3 [Ja77]	TR		TR; EIT;
Ni I	6768			PH		SOI/MDI; GONG [SOHO Instrument Page]

3 Physical Parameters

3.1 Whole Sun

$(\Delta m/\Delta t)_{\mathrm{fusion}}$	$4\mathrm{x}10^{12}$g/s [Ph92]	Age	$5\mathrm{x}10^{9}$ yr
$R_\odot$	$6.96\mathrm{x}10^{5}$km/960"	Astronomical Unit (AU)	$215R_\odot$/ $150\mathrm{x}10^{6}$km/ $93\mathrm{x}10^{6}$miles
1 "	725 km/.725 Mm	Mean Density, $\overline{\rho}$	1.4 g/cm^3 [La92]
Spectral Class Color Indices: B-V; U-B	G2V [La92] .68; .17 [La92]	App & Abs Vis Mag App & Abs Bol Mag	-26.78/4.82 [La92] -26.85/4.75 [La92]
Expected ν_e Flux Predicted (Observed) ν_e Capture Rate	$6.5\mathrm{x}10^{10}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ [La92] $5.8 \pm 1.3(2.20 \pm .24)$ SNU [La92]	Moment of Inertia Angular Momentum	$6\mathrm{x}10^{53}\mathrm{gcm}^2$ [La92] $1.6\mathrm{x}10^{48}\mathrm{g}\cdot\mathrm{cm}^2/\mathrm{s}$ [La92]

3.2 Large-Scale

Layer	$R/R_\odot$	$\langle T \rangle$	$\rho(\mathrm{g/cm}^3)$	$\log(P)(\mathrm{dyne/cm}^2)$	$c_S = \sqrt{3kT/m_e}; v_A = B/\sqrt{4\pi\rho}$ (cm/s)
core	$< .1R_\odot$	R=0: 15.6 MK [Ph92]	R=0: 150 [La92]	R=0: 18 [Al73]	–
rad'n zone	$.1 - .7R_\odot$	$R = .4R_\odot$: 4.8 MK [Al73]	$R = .4R_\odot$:∼30 [La92]	$R = .4R_\odot$:15 [Al73]	–
conv'n "	$> .7R_\odot$	.7/.9/.99 $R_\odot$: 1.2/.3/.05 MK [Al73]	$10^{1/-0/-1}$ [La92]	13/11/8 [Al73]	$(7/4/1)\mathrm{x}10^8$;1/10/100xB(G)
p-sphere	1 $R_\odot$	5778 K [Ph92]	10^{-7} [Ve81]	5 [Ve81]	$5\mathrm{x}10^7$;10^3xB(G)
temp.min.	" + 500 km	4500 K [Av91]	10^{-9} [Ve81]	3-4 [Ve81]	$5\mathrm{x}10^7$;10^4xB(G)
ch-sphere	" + 1000-1800 km	6000-8000 K [Av91]	$10^{-11-(-12)}$ [Ve81]	1-.1 [Ve81]	$5\mathrm{x}10^7$;10^5xB(G)
trans. reg.	" + 2500 km	10^5 K [Av91]	$2\mathrm{x}10^{-15}$[Ve81]	-1 [Ve81]	$2\mathrm{x}10^8$;$5\mathrm{x}10^6$xB(G)
corona	" + > 5000 km	2 MK [Sc94]	, 10^{-15} [Go97]	-8 [Pr82]	10^9; 10^{8-9} (AR: B=100 G) [Sc94]

4 Hemispheric Patterns of Chirality

Phenomenon	Property	North(South) Hem. Chir.	comment	ref
Filament	channel	dextral[1] (sinistral)	channel ≡ fibrils along PIL	[Zi97]
“	barbs	right(left)-bearing	’highway exit ramps;’ end in minority flux	[Zi97]
“	X-ray arcades	ccw (cw) loop axes	axes rotate w/height	[Zi97]
“	field lines	as left(right)-hand screw	assumes “flux rope” model	–
active region (AR)	soft x-ray loops	N(S)-shaped	“sigmoid” shapes are prone to erupt	–
AR vec. mag’grams	current helicity	negative (positive)	this is $\mathbf{J} \cdot \mathbf{B}$, not $\mathbf{A} \cdot \mathbf{B}$	[Zi97]
sunspot penumbrae	fibril whorls	ccw (cw)	whorls rare: in $\sim 5\%$ of spots	[Zi97]
magnetic clouds	twist	left(right)-handed	interplanetary, measured in-situ	[Zi97]
				[Zi97]

1. dextral ≡ axial field points to right when viewed from region where normal magnetic field is positve.

5 Flare - Associated Radio Bursts

Type	f Mhz	lifetime (s)	timing	cause	comment	ref
I	$50 - 400$	$> 10^5$	onset–¿	plasma osc.	100% polarized	[Fo90]
II	$< 10^2$	$10^2.5$	onset–¿	plasma osc.		[Fo90]
III	$10^{(-2)-(+2)}$	10^2	fl.onset	trapped e^-’s	“U-bursts”	[Fo90]
IV	$10^{(-1)-(+4)}$	10^3	simult.w/fl.	e^- gyrosynchr.		[Fo90]
“moving” IV	$10^{(+1)-(+2)}$	“	“	“	most studied	[Fo90]

References

[Al73] Allen, C.W., Allen’s Astrophysical Quantities, 3rd ed., London: Athlone Press, 1973.

[Ar85] Arnaud, M., and Rothenflug, R., A. & A. Suppl. Ser., 1985, v. 60, 425.

[Av91] Avrett, E.H., in Ulmschneider, P., Priest, E.R., and Rosner, R., Mechanisms of Chromospheric and Coronal Heating, Berlin: Springer-verlag, 1991, pp. 97 - 99.

[Go97] Golub, L. and Pasachoff, Jay M., The Solar Corona, Cambridge: Cambridge University Press, 1997.

[Fo90] Foukal, P., Solar Astrophysics, New York: Wiley, 1990.

[Hu94] Huba, J.D., NRL Plasma Formulary, NRL/PU/6790–94-265.

[Ja77] Jacobs, Davis, Kepple, and Blaha, A. & A., 1977, v. 211, 612.

[Ja80] Jacobs, et al., Ap. J, 1980, v. 239, 1119.

[Jo69] Jordan, et al., MNRAS, 1969, v. 142, 501.

[La92] Lang, K. R., Astrophysical Data: Planets and Stars, New York: Springer-Verlag, 1992.

[Ph92] Phillips, K. J. H., Guide to the Sun, Cambridge: Cambridge University Press, 1992.

[Pr82] Priest, E. R., Solar Magnetohydrodynamics, Boston: D. Reidel, 1982.

[St89] Stix, M., The Sun, An Introduction, Berlin: Springer-Verlag, 1991.

[Sc94] Schmelz, J.T., Holman, G.D., Brosius, J.W., Willson, R.F., Ap. J., v. 434, 786-794.

[To97] Topka, K. P. and Tarbell, T. D. and Title, A.M., Ap. J., 1997, v. 484, 479.

[Ve81] Vernazza, J.E., Avrett, E.H., Loeser, R., Ap. J. Supp., v. 45, 635; found in [St89].

[Wi77] Withbroe, G.L., and Noyes, R. W., Ann. Rev. Astrophys., 1977, v. 15, 363, 1977; found in [Hu94].

[Zi97] Zirker, J.B., Martin, S.F., Harvey, K., Gaizauskas, V. Sol. Phys., v. 175, 27-44, 1997.

[Zw87] Zwaan, C., Ann. Rev. Astrophys., 1987, v. 25, 83, 1987.