

# Popatrzmy na Słońce

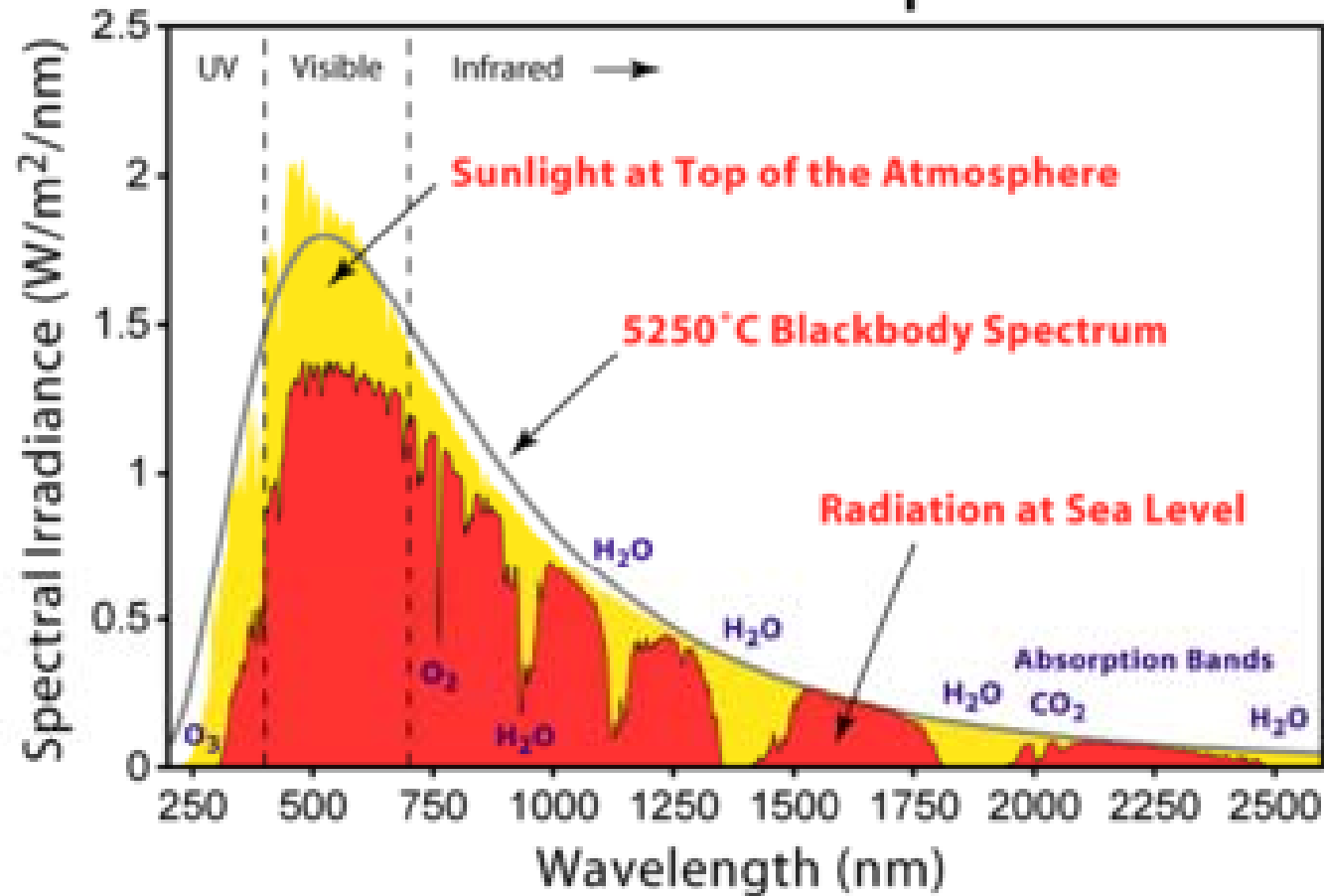


Marek Demiański  
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Uniwersytet Warszawski

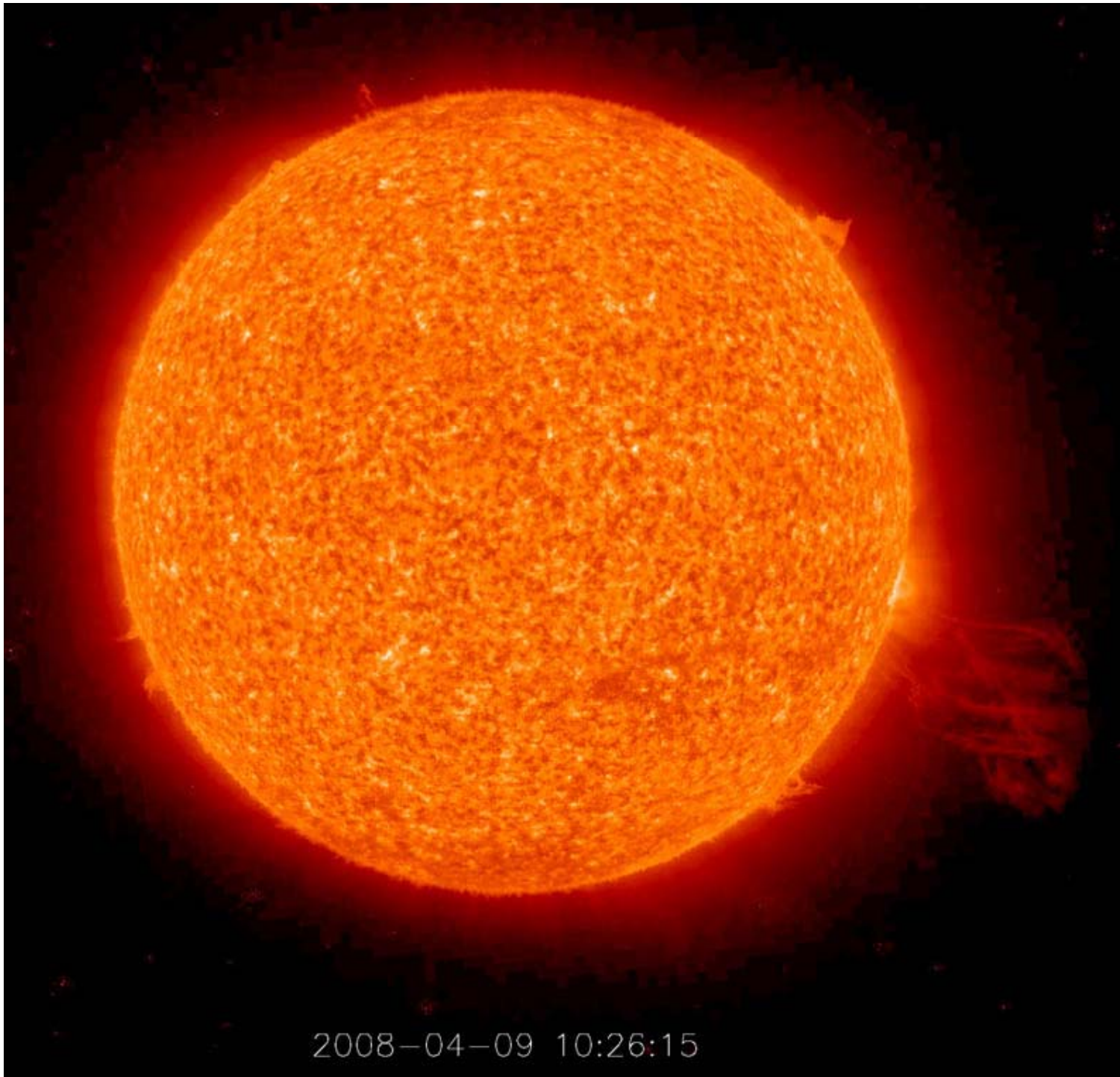


2008/06/11 05:03

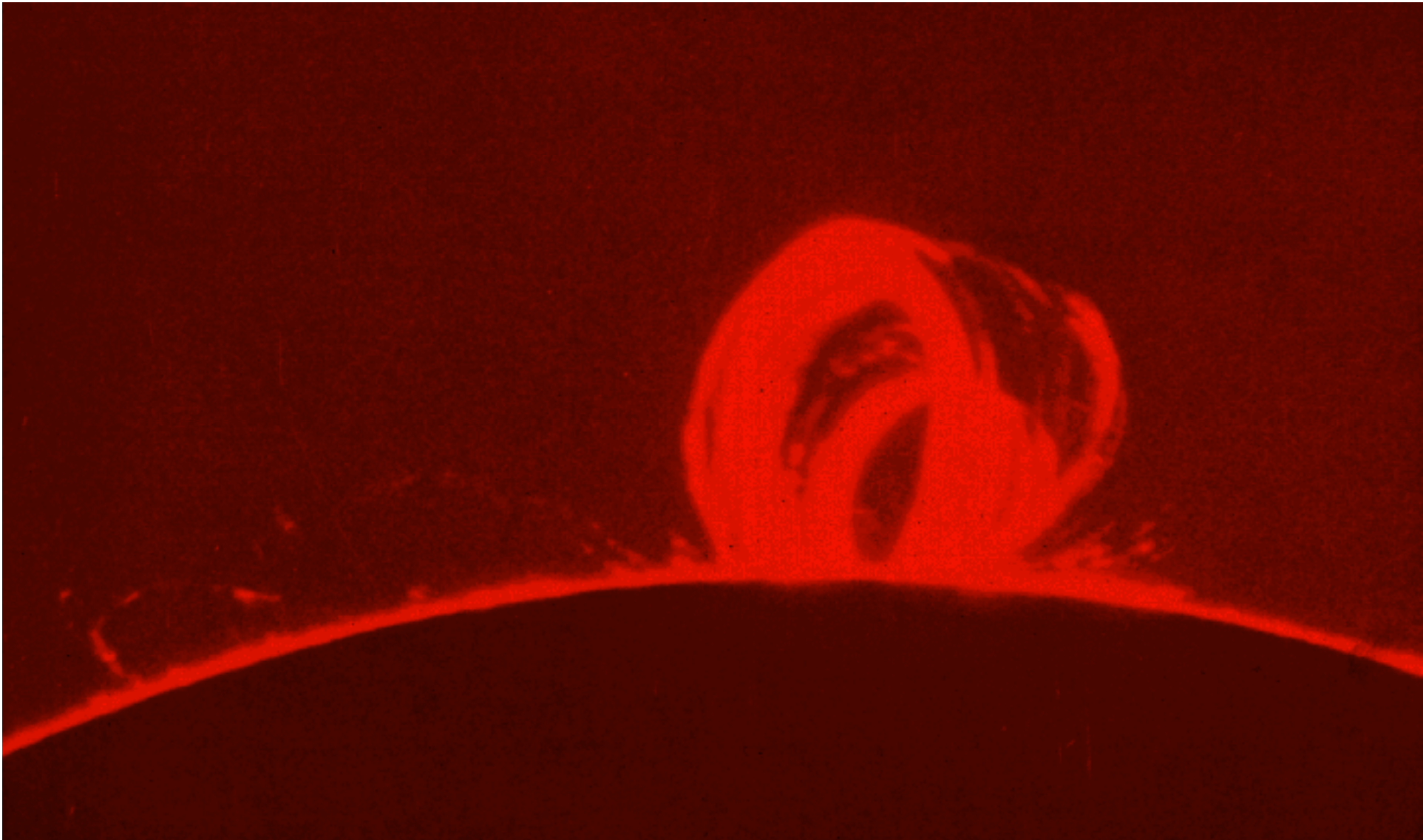
# Solar Radiation Spectrum

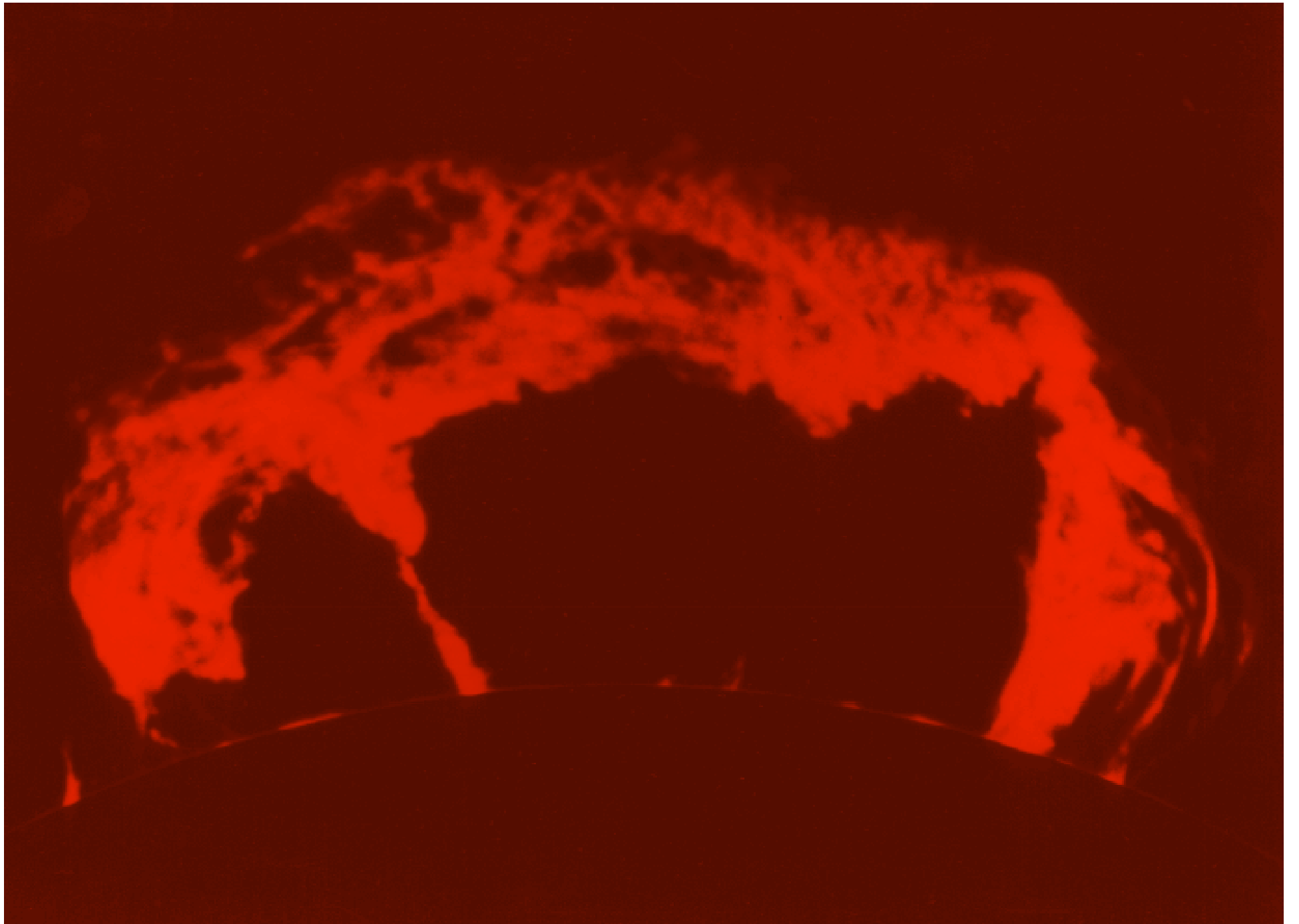


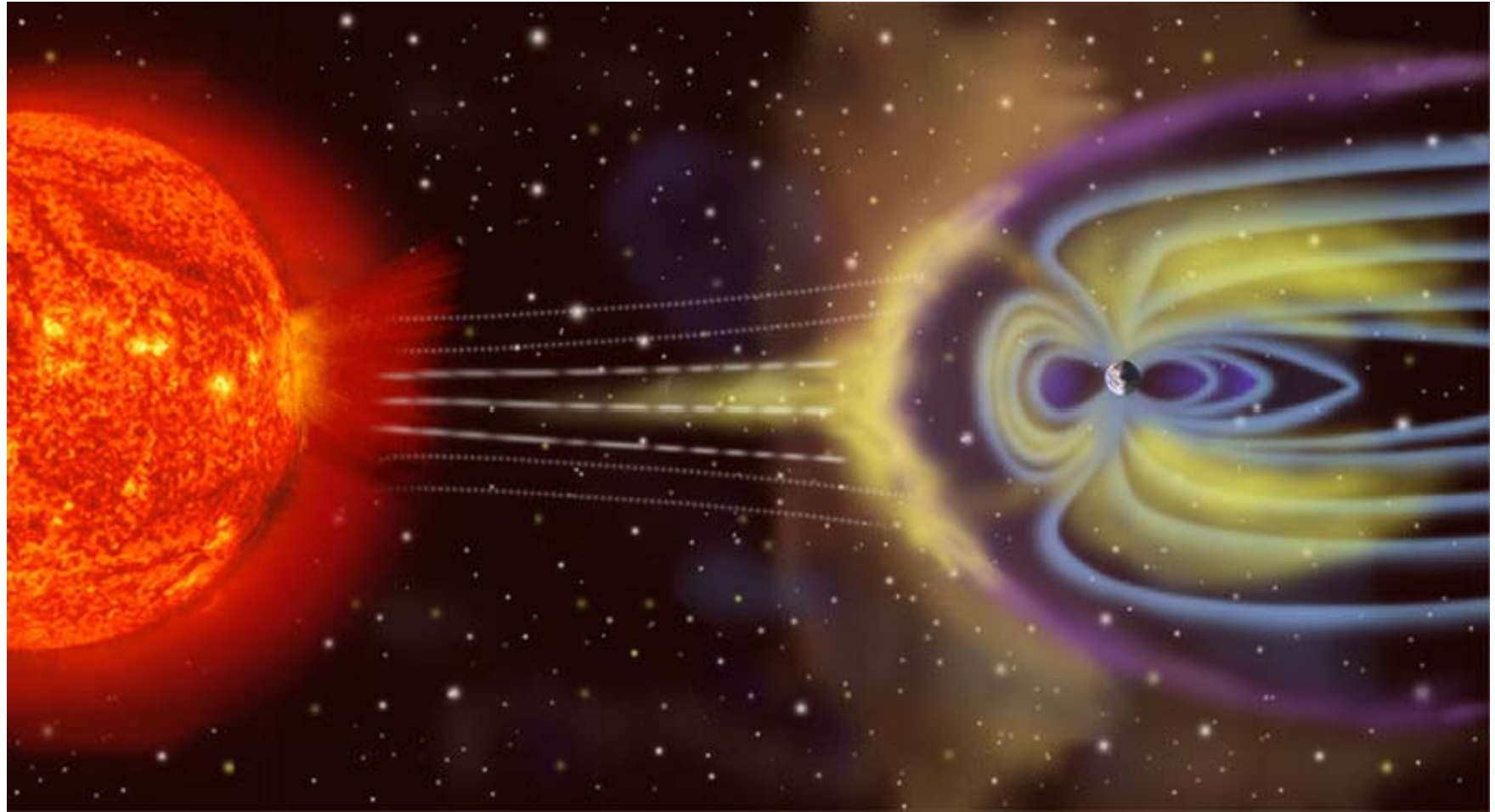
<http://sohowww.nascom.nasa.gov>



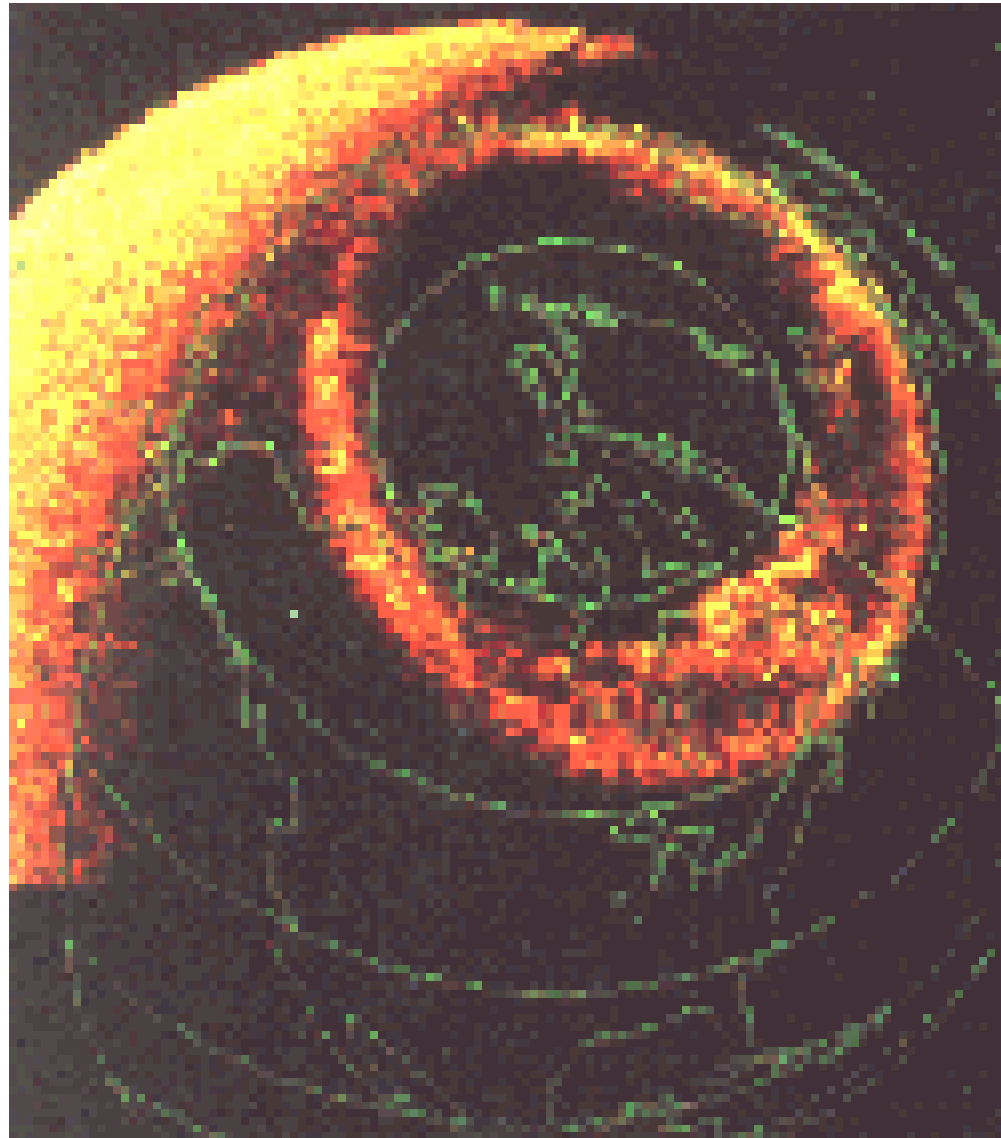
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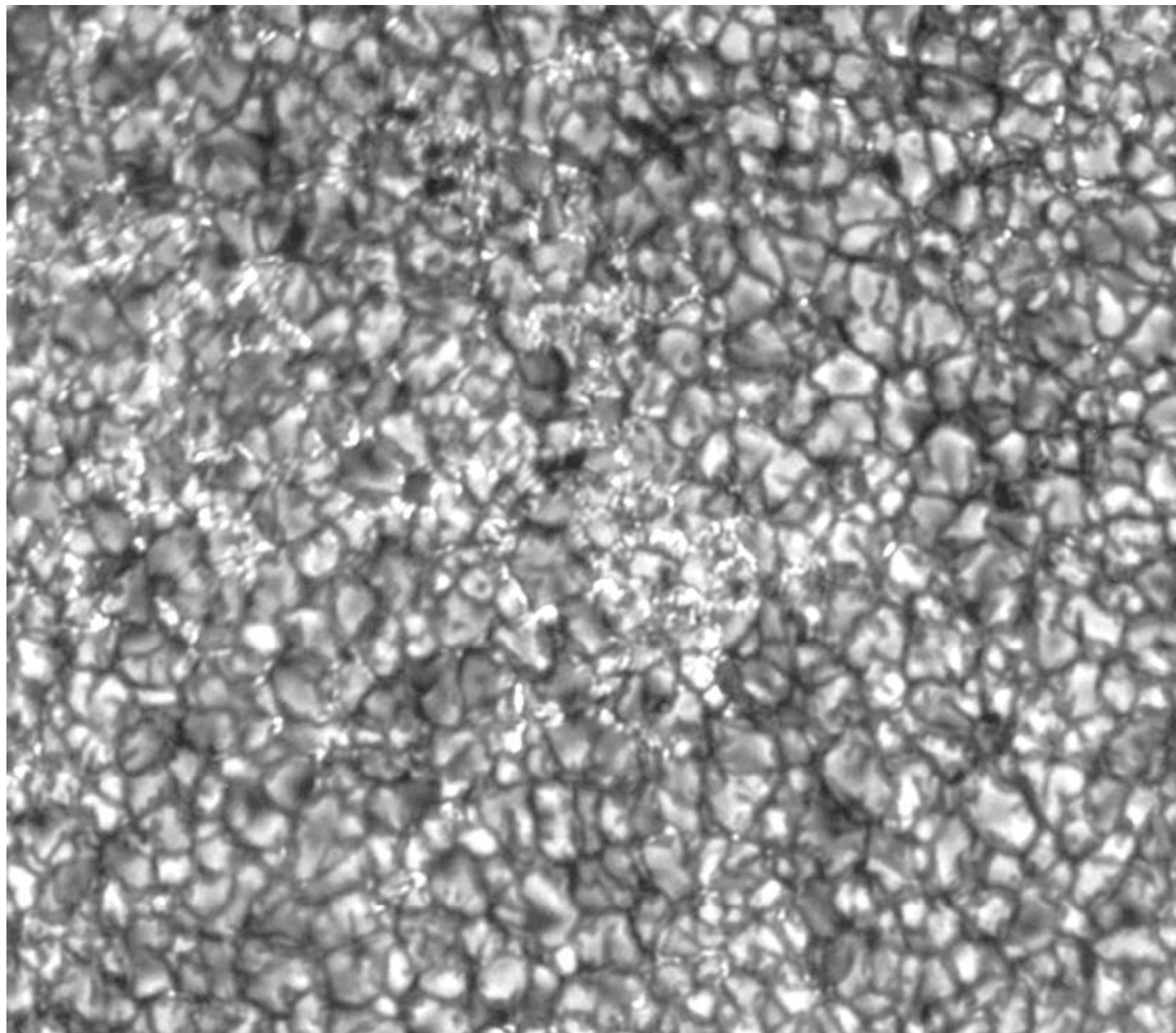


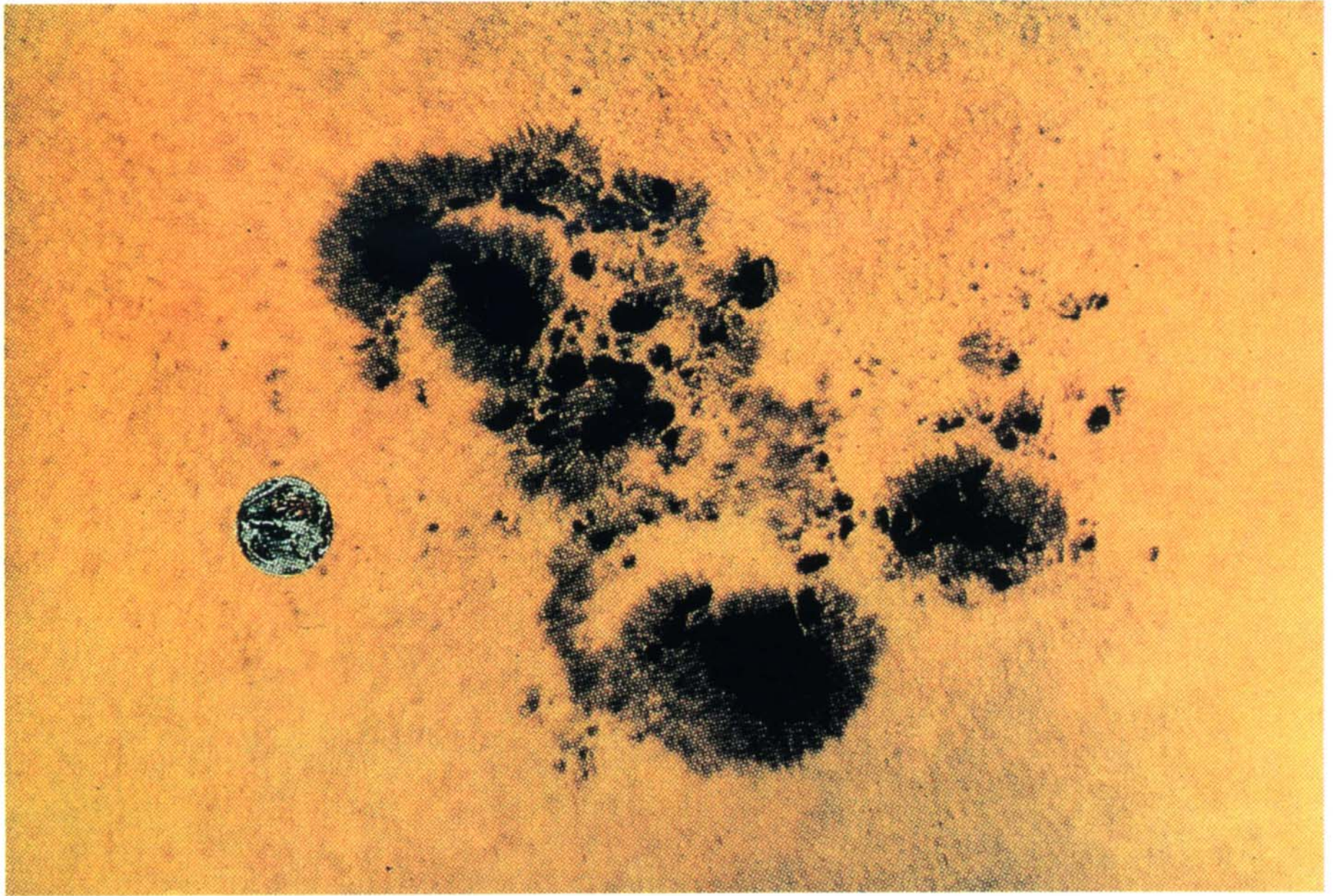




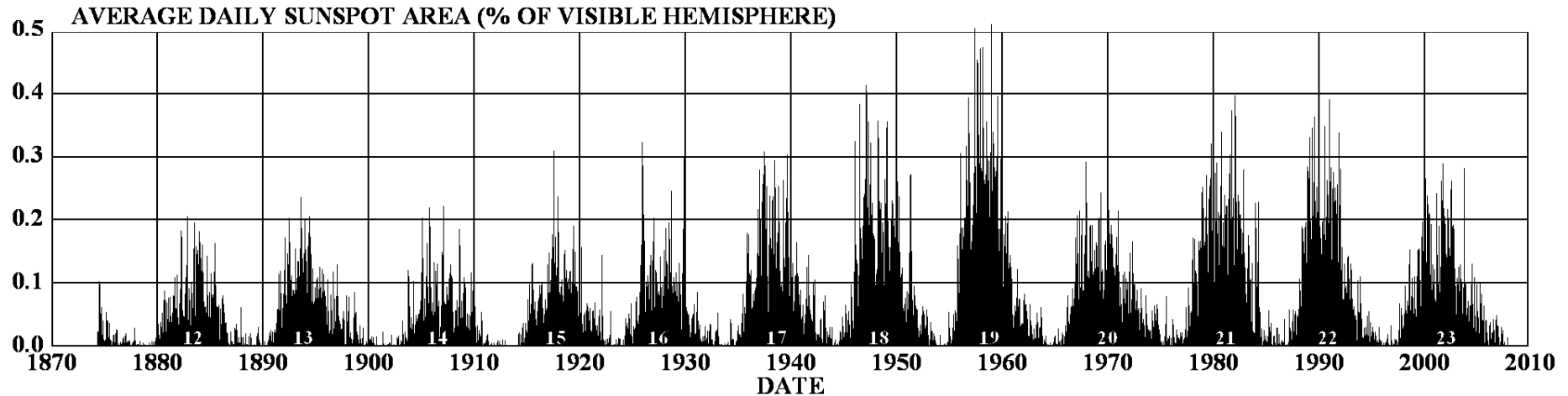
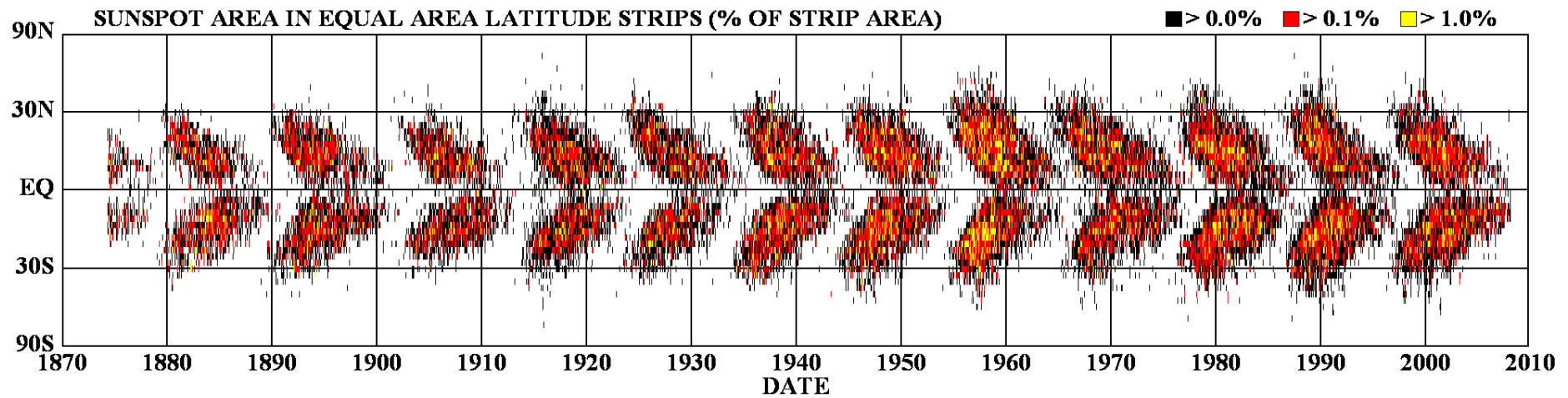


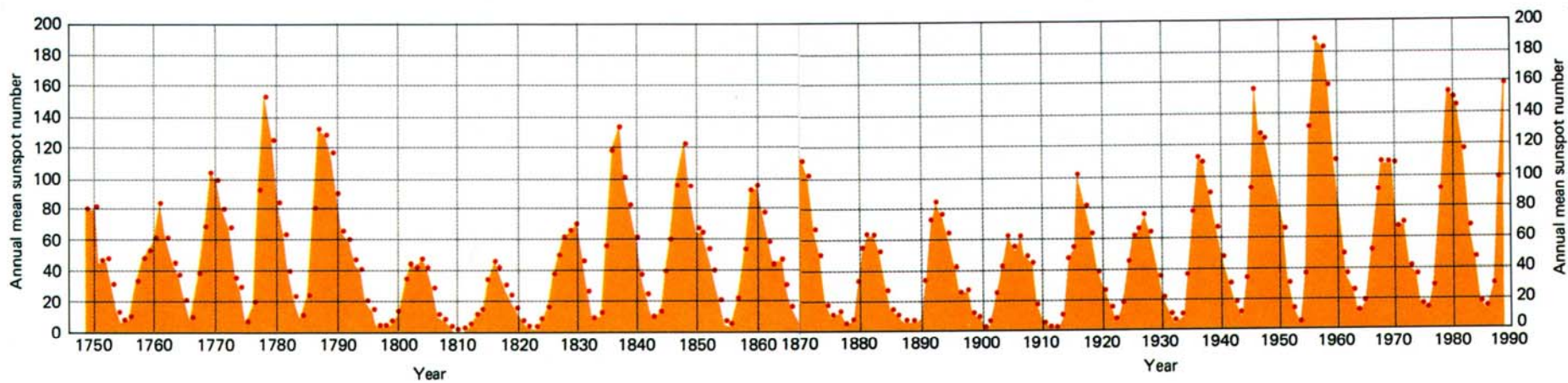




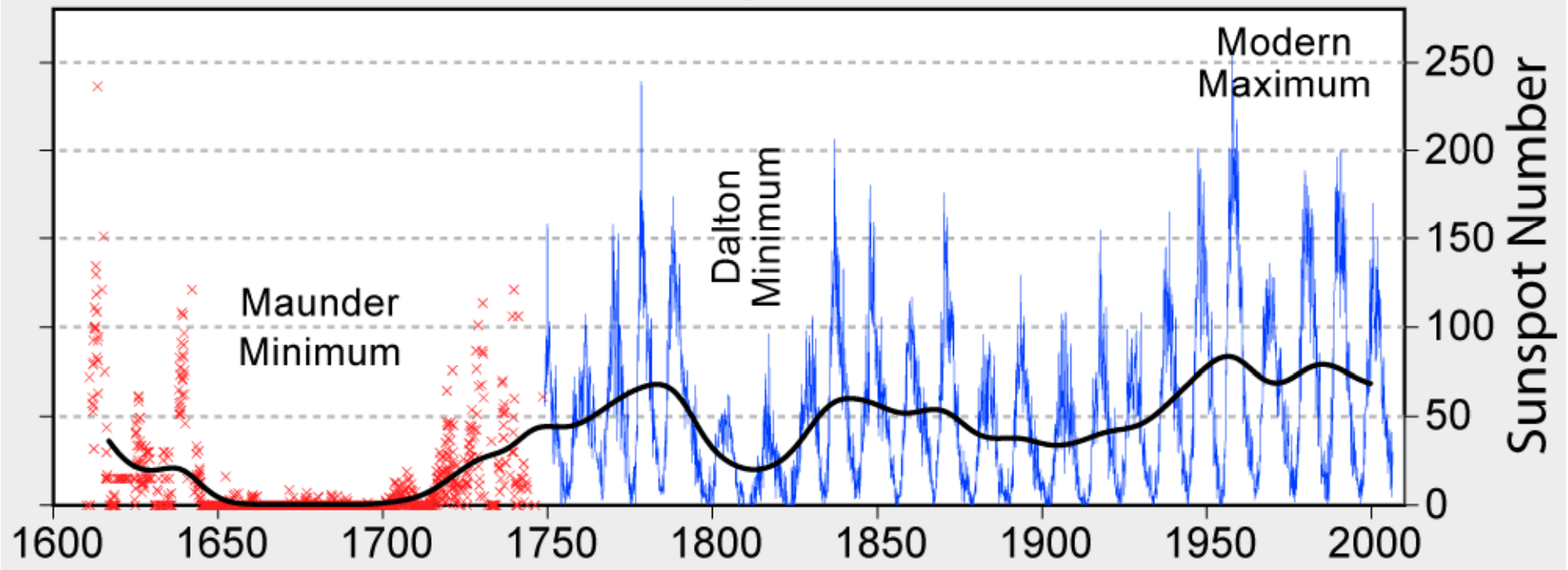


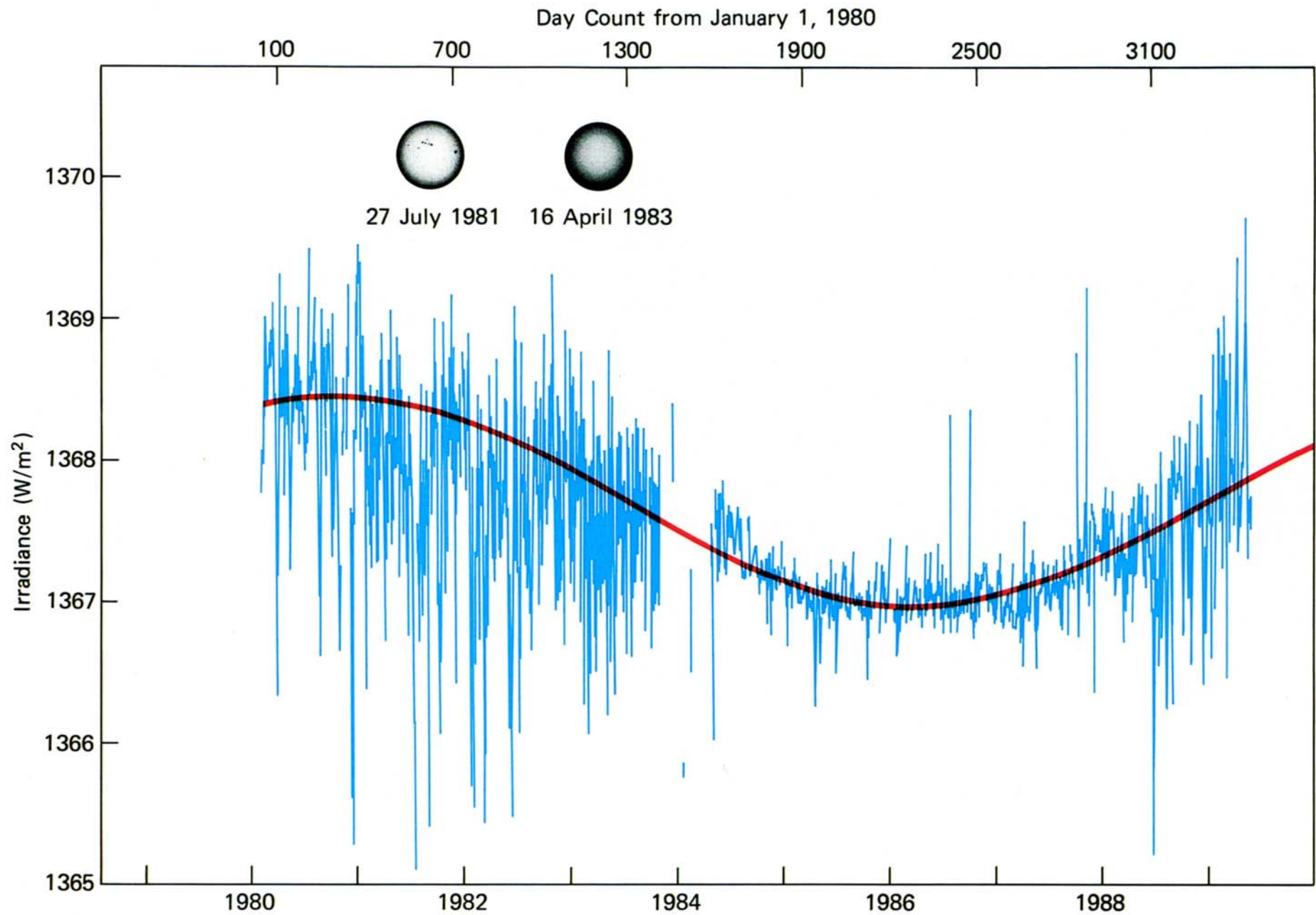
# DAILY SUNSPOT AREA AVERAGED OVER INDIVIDUAL SOLAR ROTATIONS





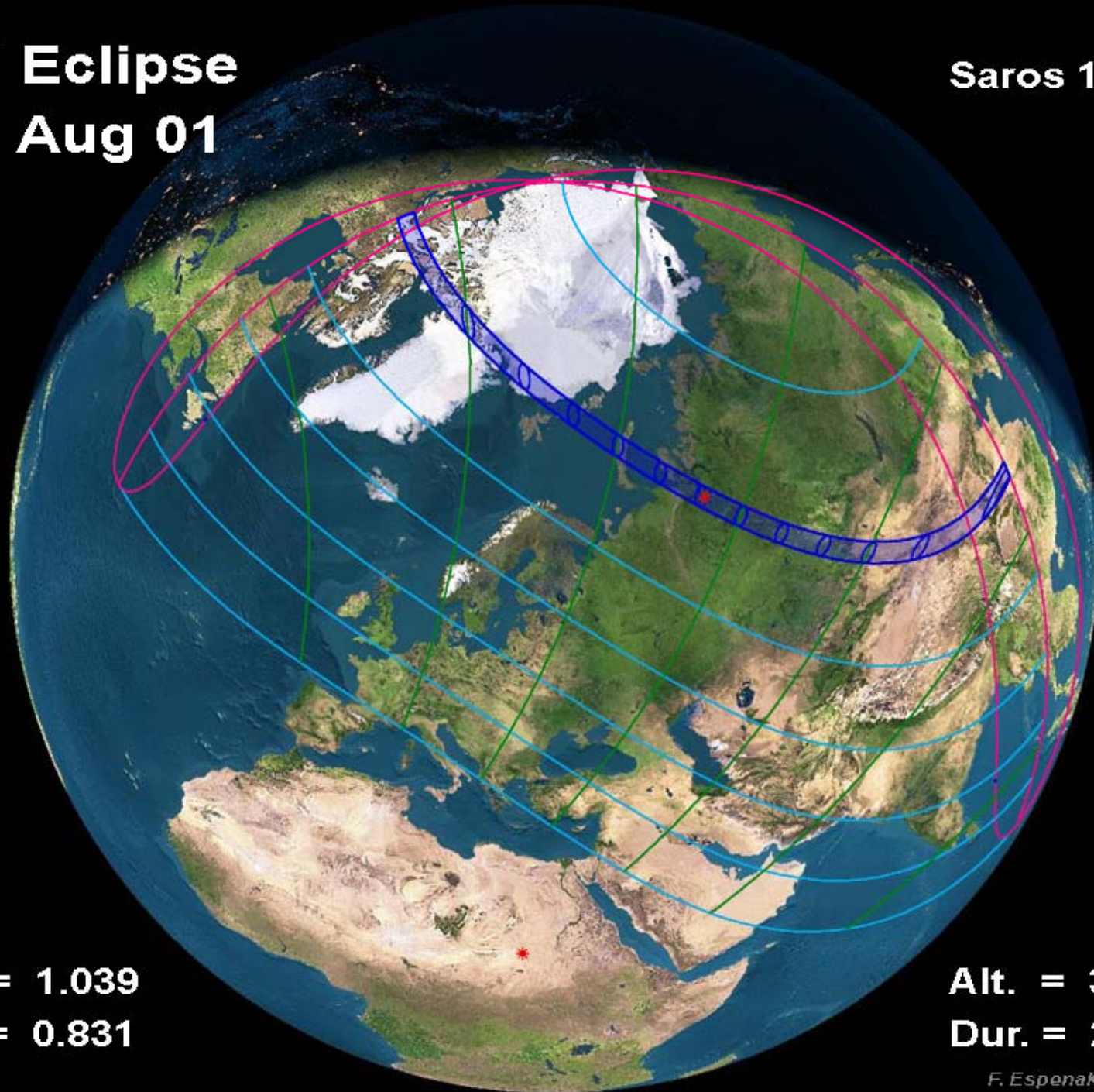
# 400 Years of Sunspot Observations





# Total Eclipse 2008 Aug 01

Saros 126



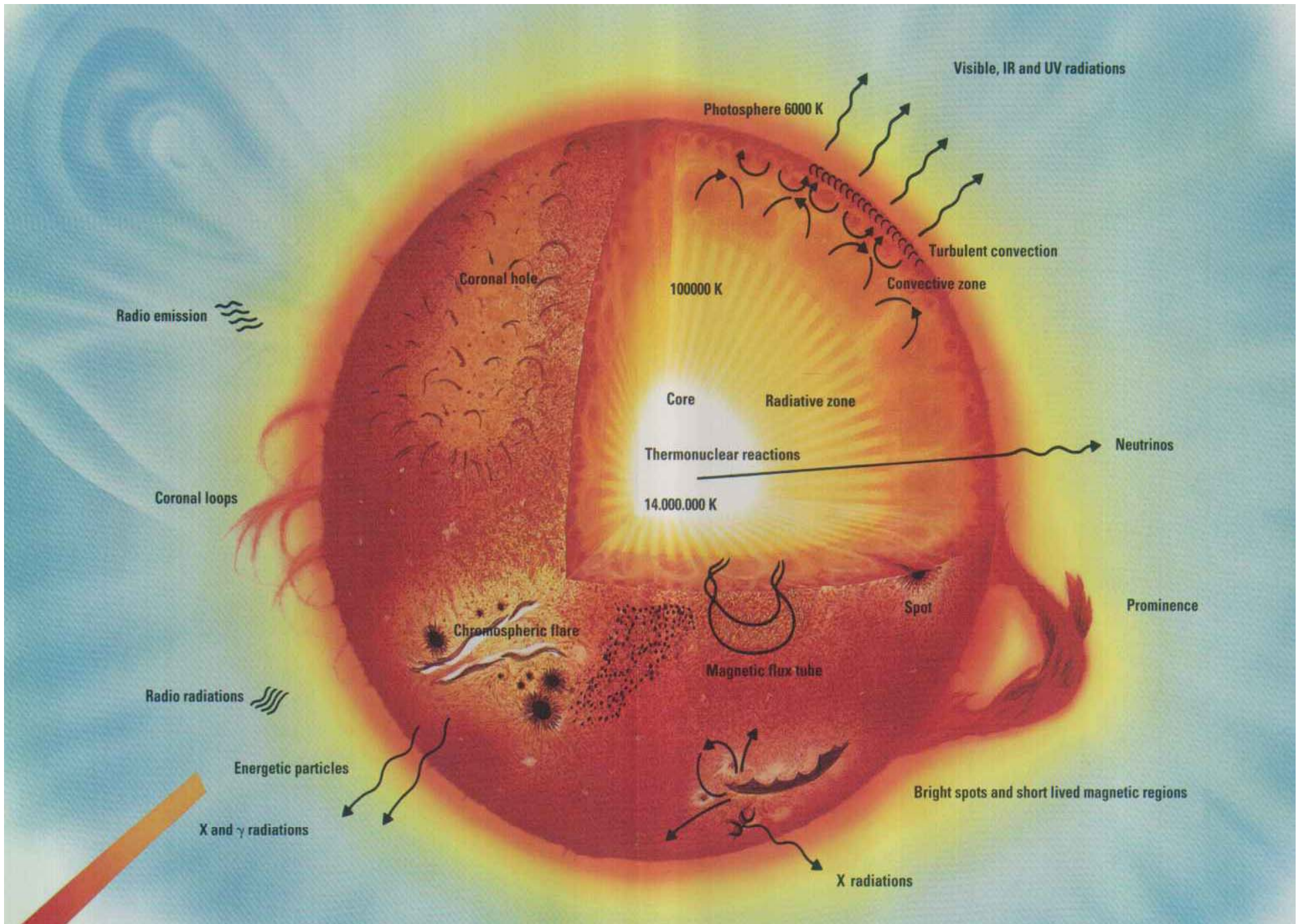
Mag. = 1.039  
Gam. = 0.831

Alt. = 34°  
Dur. = 2<sup>m</sup> 27<sup>s</sup>

*F. Espenak, NASA's GSFC*

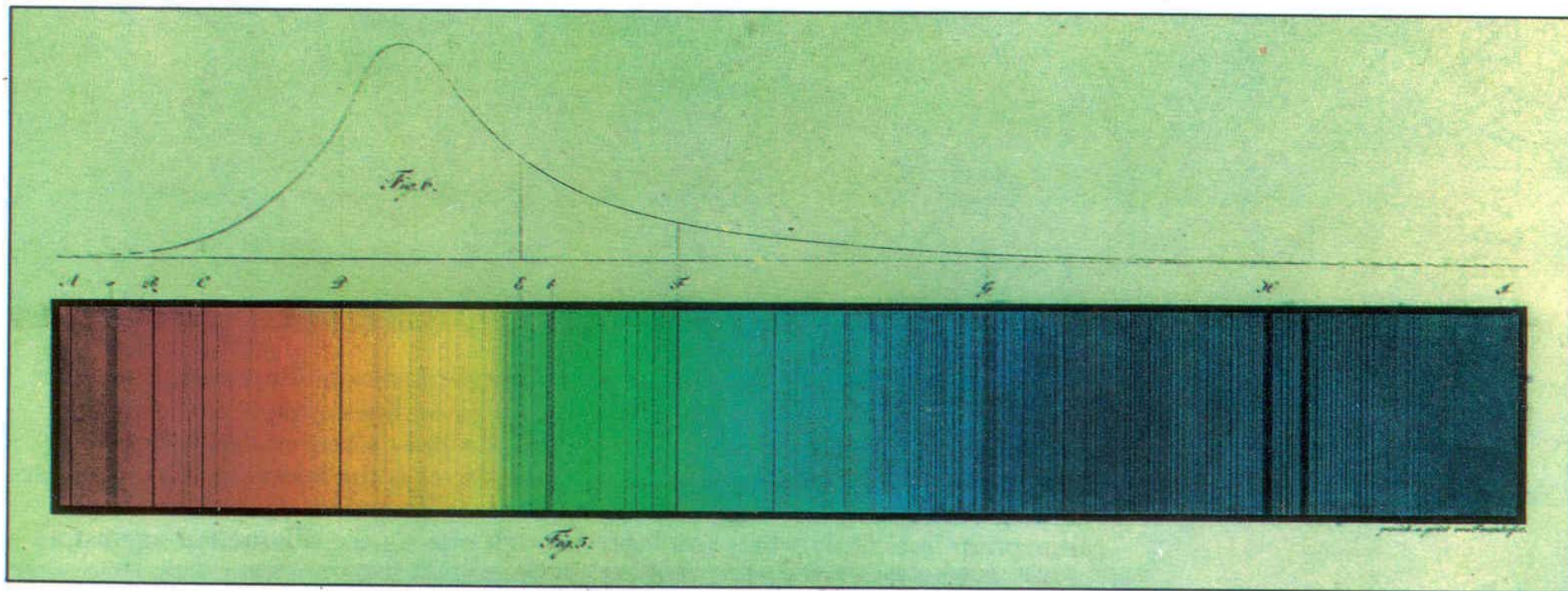


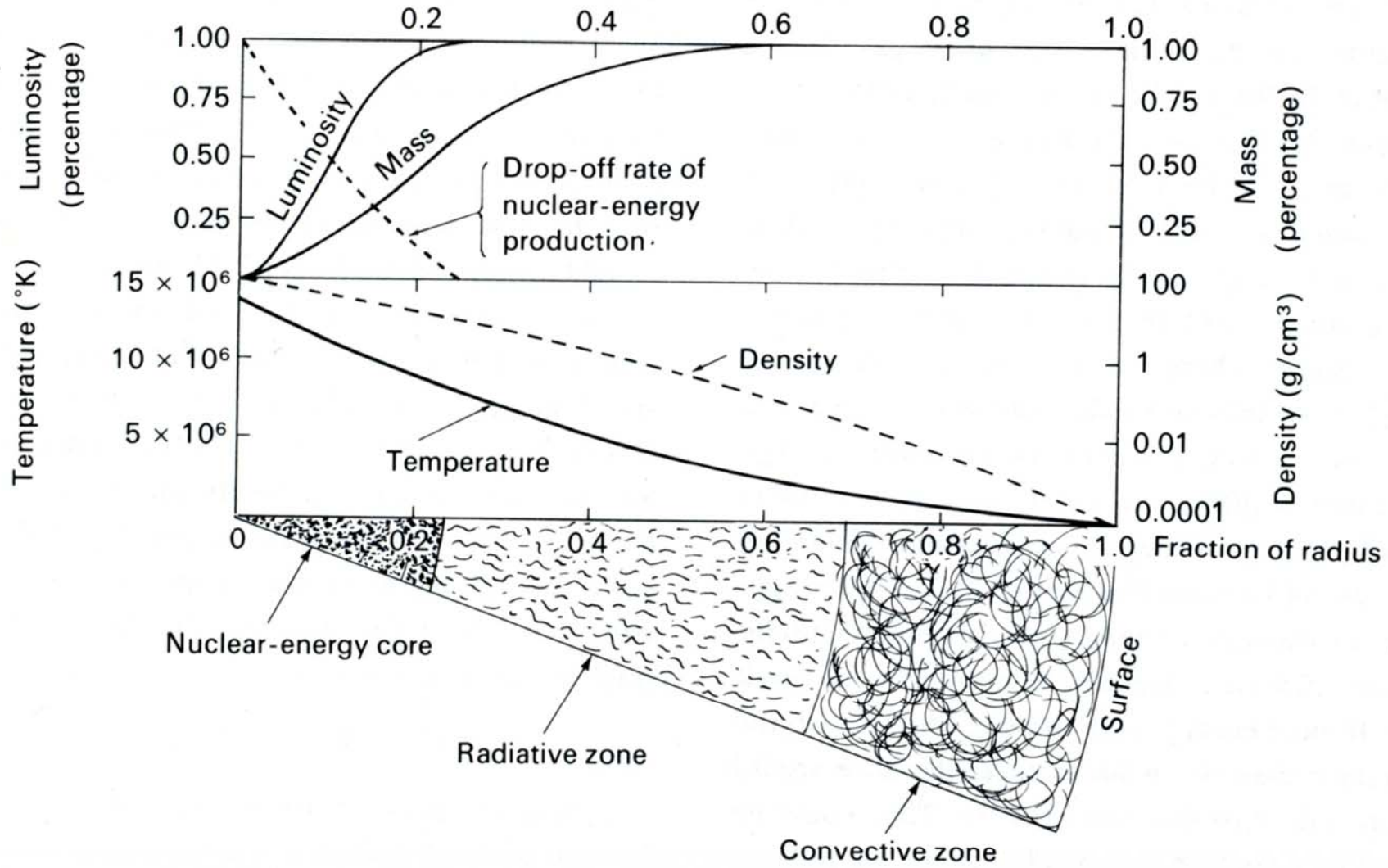


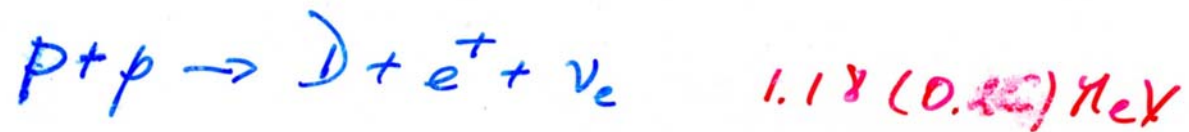


# Skład chemiczny Słońca

Pierwiastek	% atomów	% masy
Wodór	91.2	71.0
Hel	8.7	27.1
Tlen	0.078	0.97
Węgiel	0.043	0.40
Żelazo	0.030	0.014
Siarka	0.015	0.040
Azot	0.0088	0.096
Krzem		0.0038
Magnez		
0.076		
Neon	0.0045	0.099
0.0035	0.058	







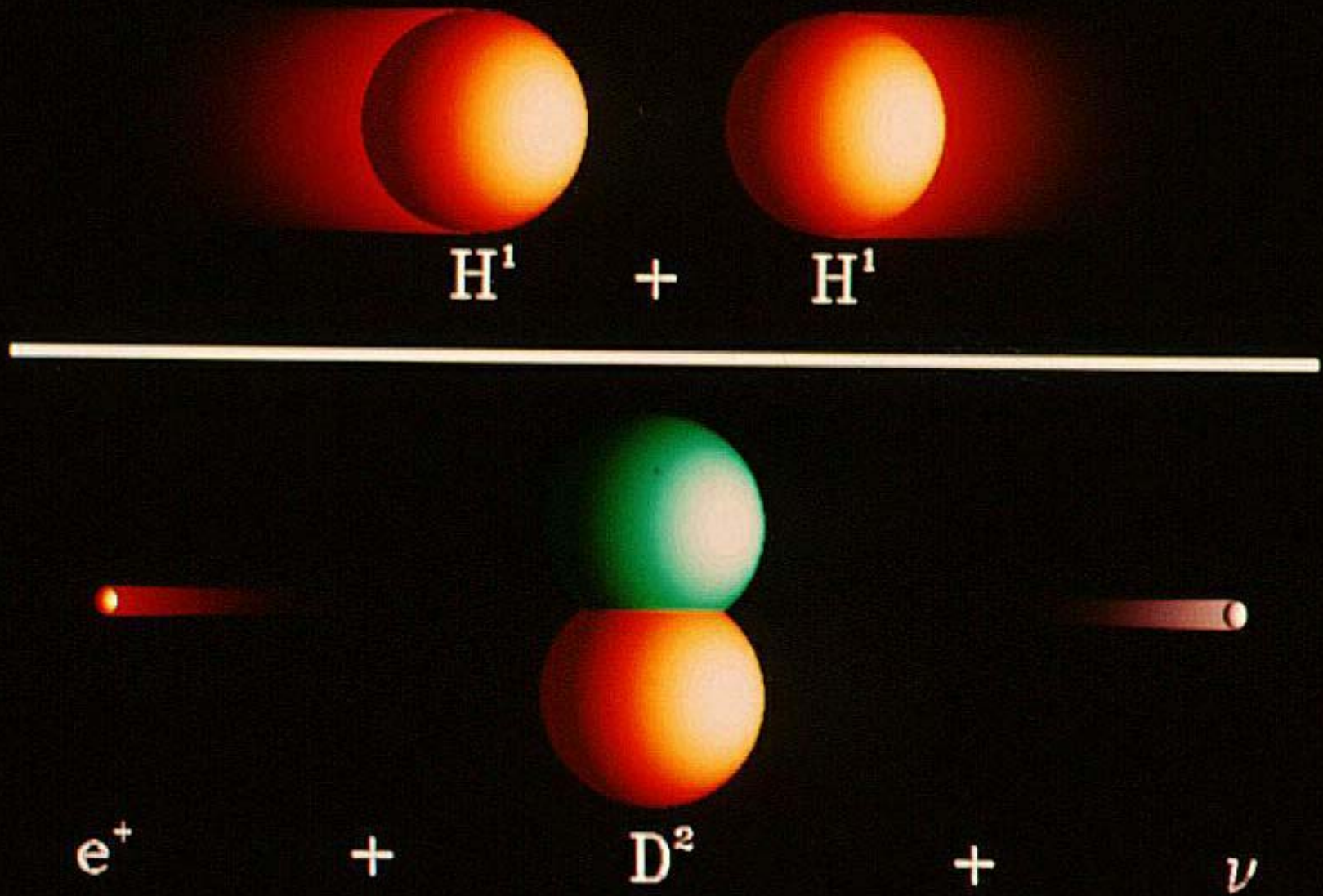
Total energy released per  $He^4$  26.2 MeV

$$1 \text{ MeV} = 10^6 \text{ eV}$$

$$1 \text{ eV} = 1.6 \times 10^{-12} \text{ erg} = 1.602 \times 10^{-19} \text{ J}$$

$$1 \text{ eV} \sim 10^4 \text{ K} \quad (11605.4 \text{ K})$$

# STEP 1



STEP 2

$D^2$

+

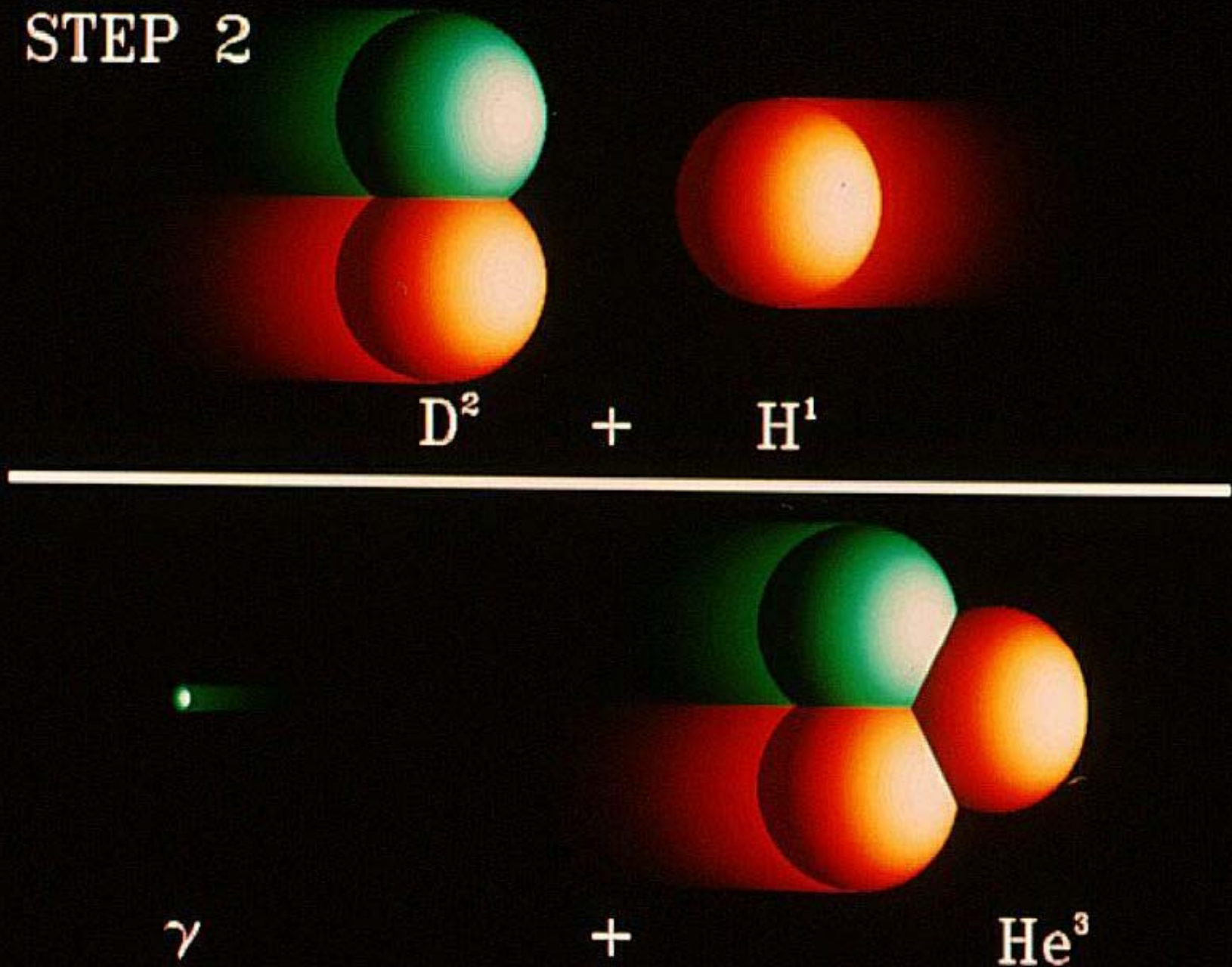
$H^1$

$\gamma$

+

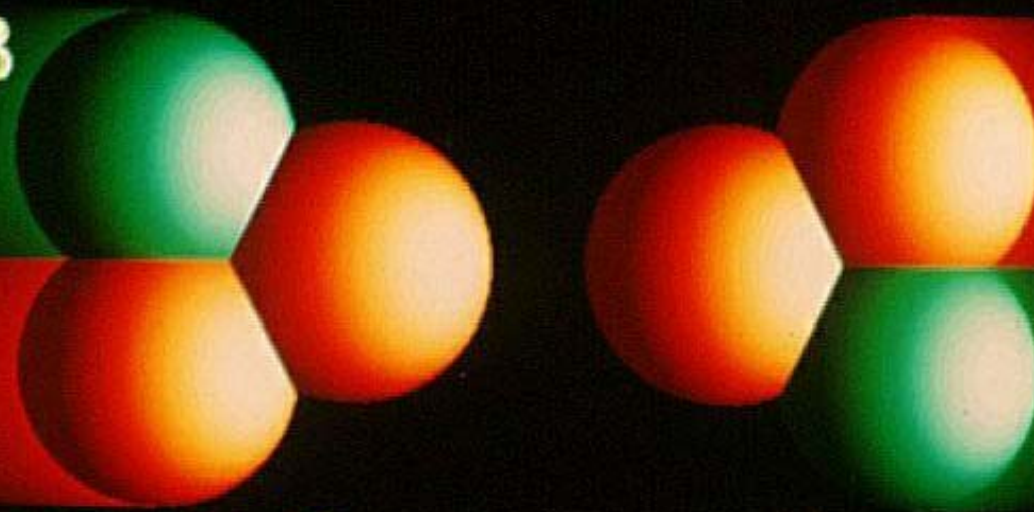
$He^3$

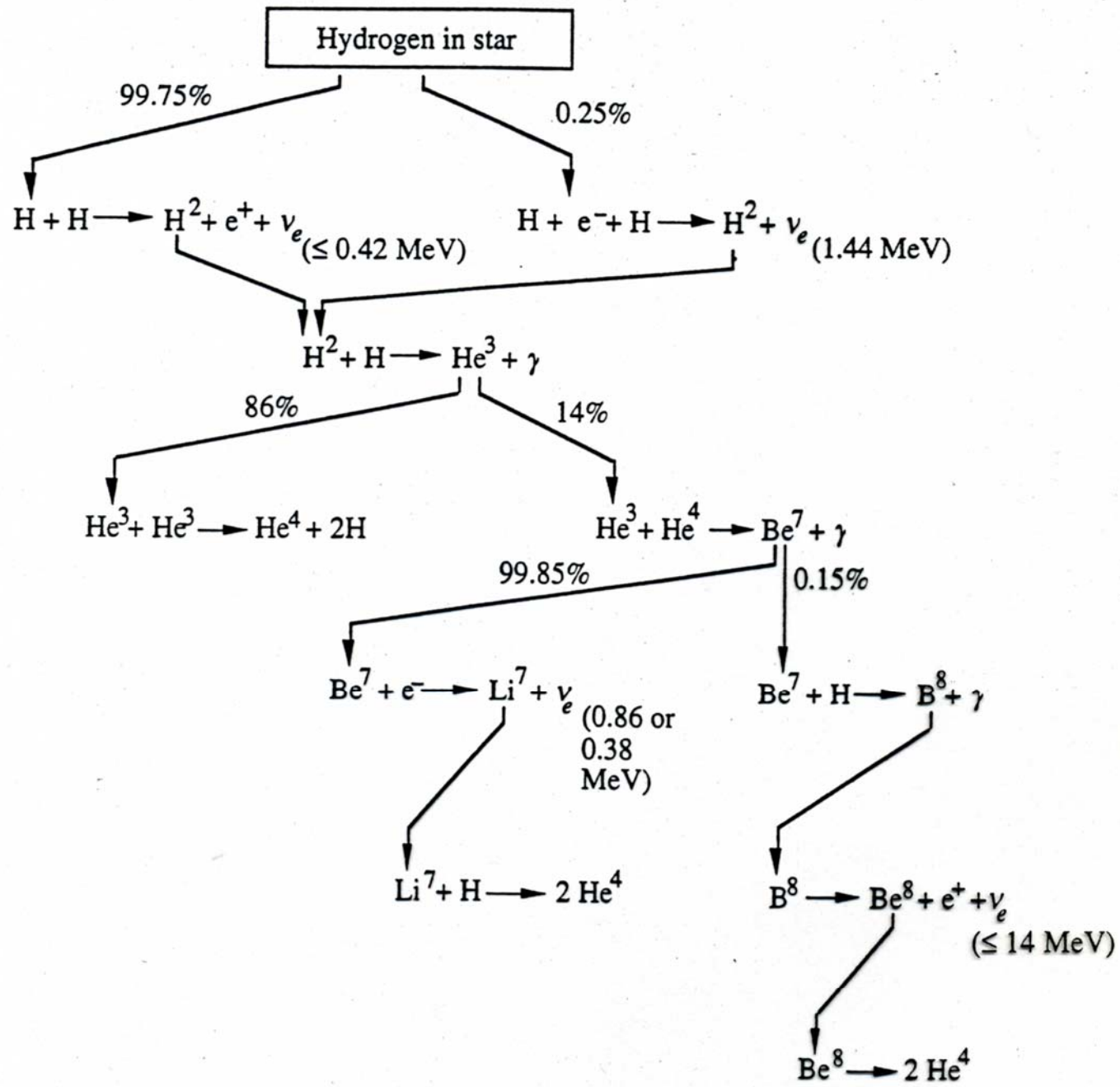
NASA/NSSTC/Hathaway

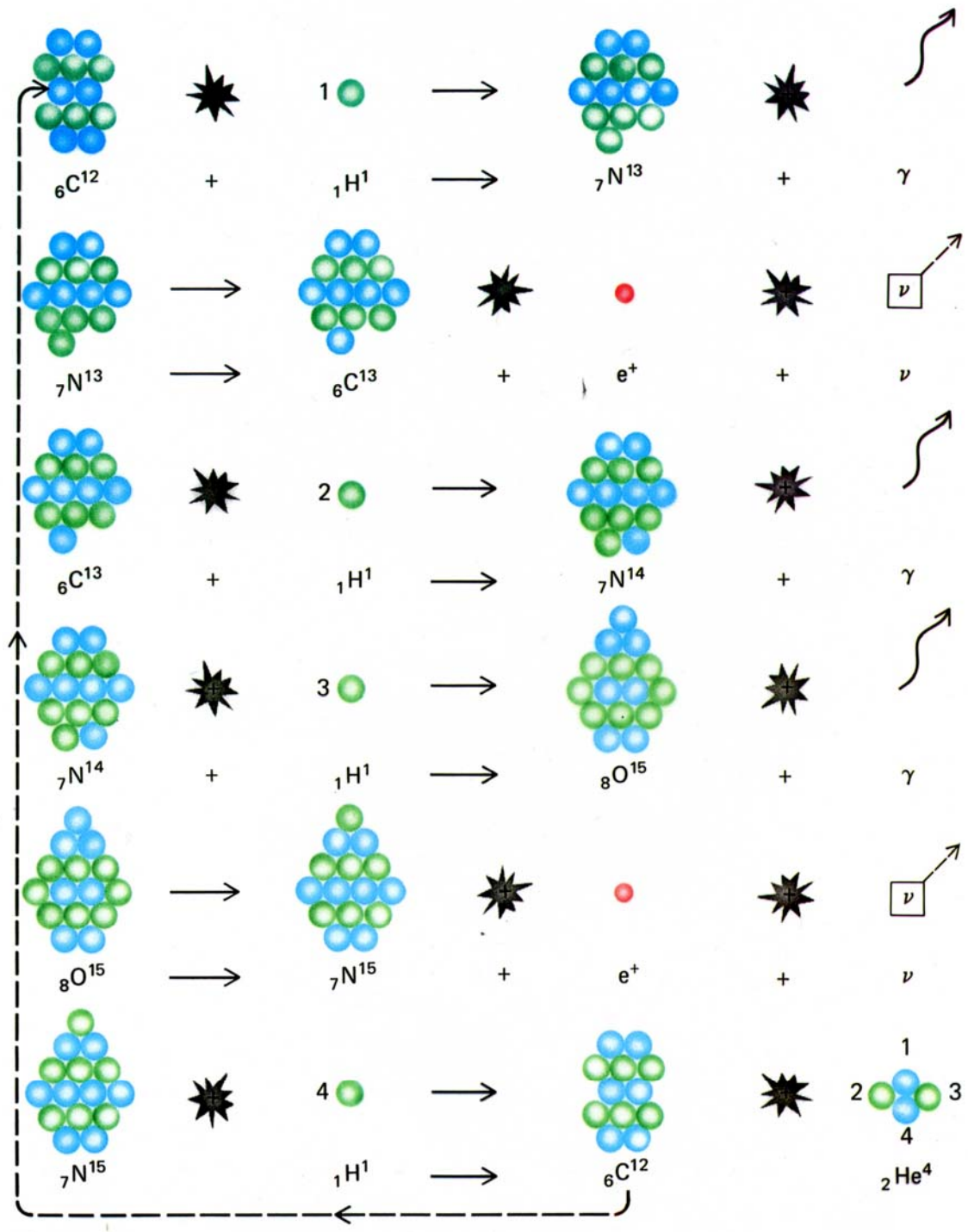


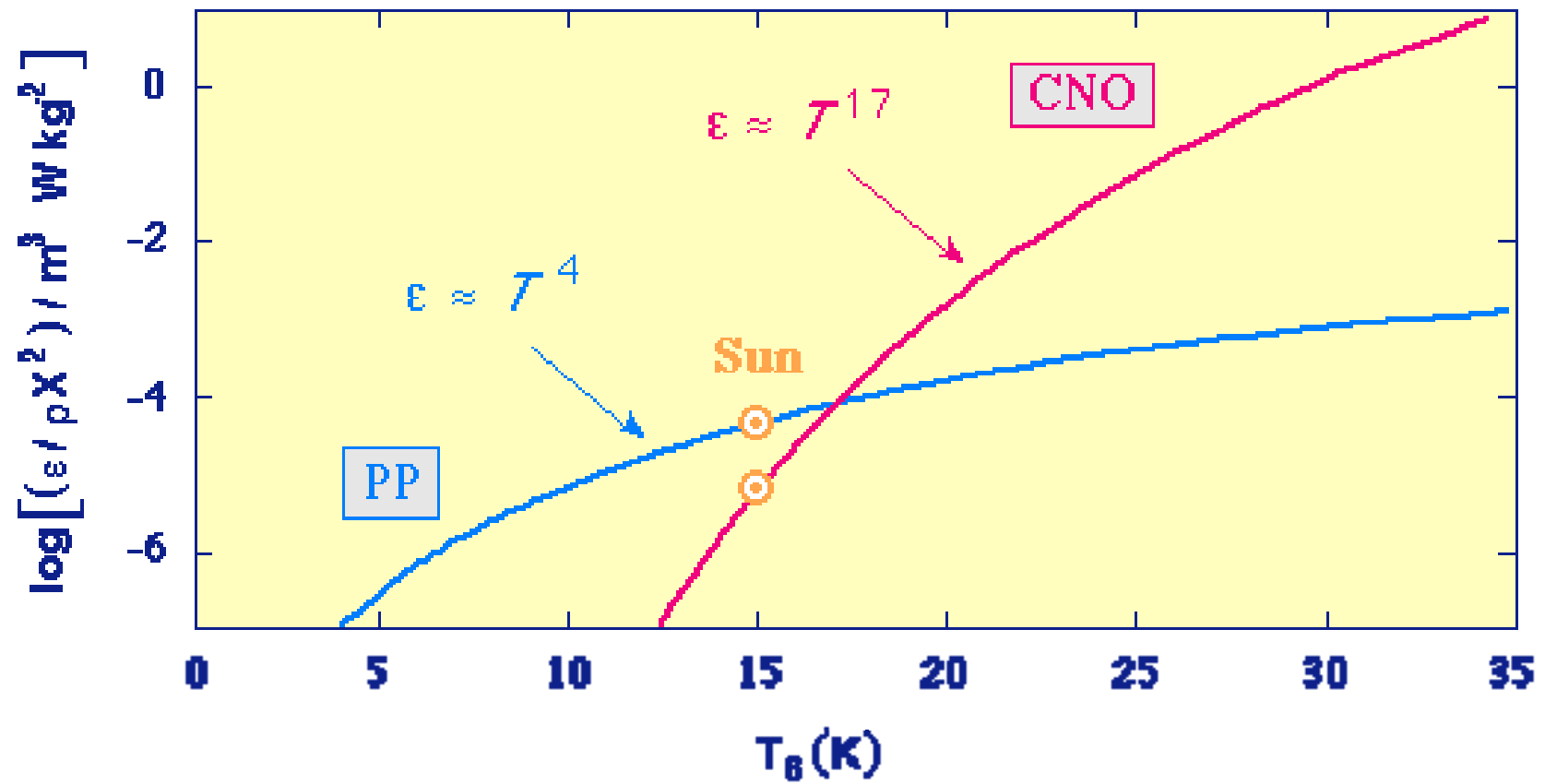


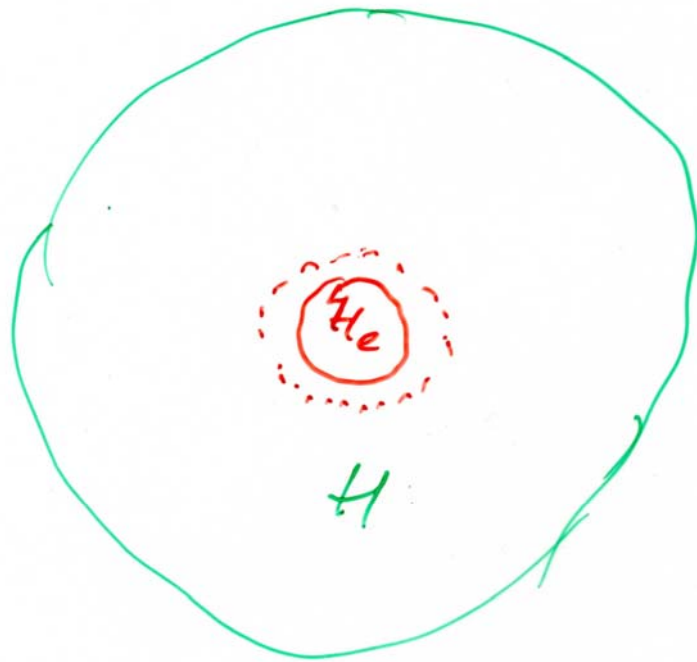
STEP 3

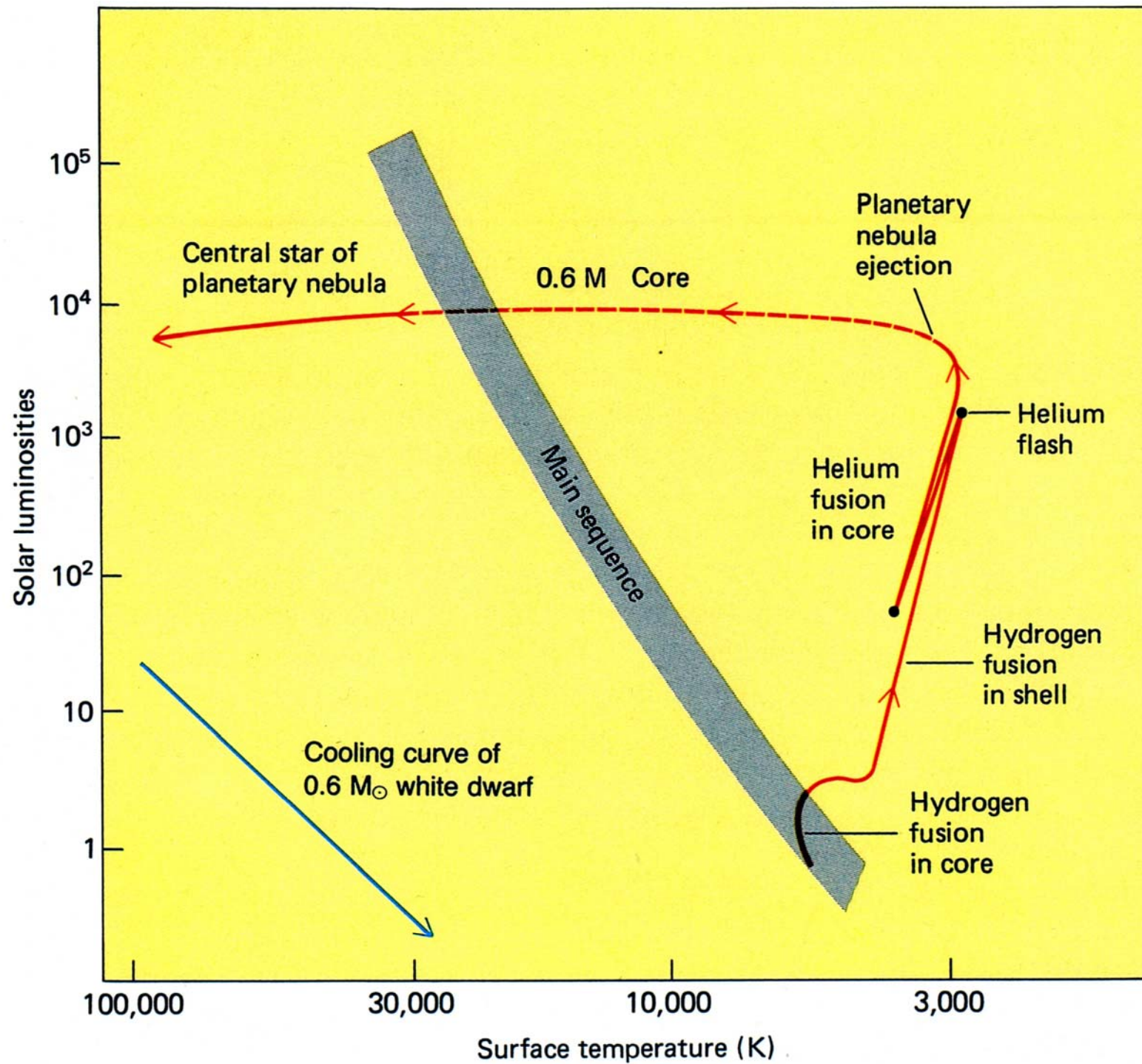












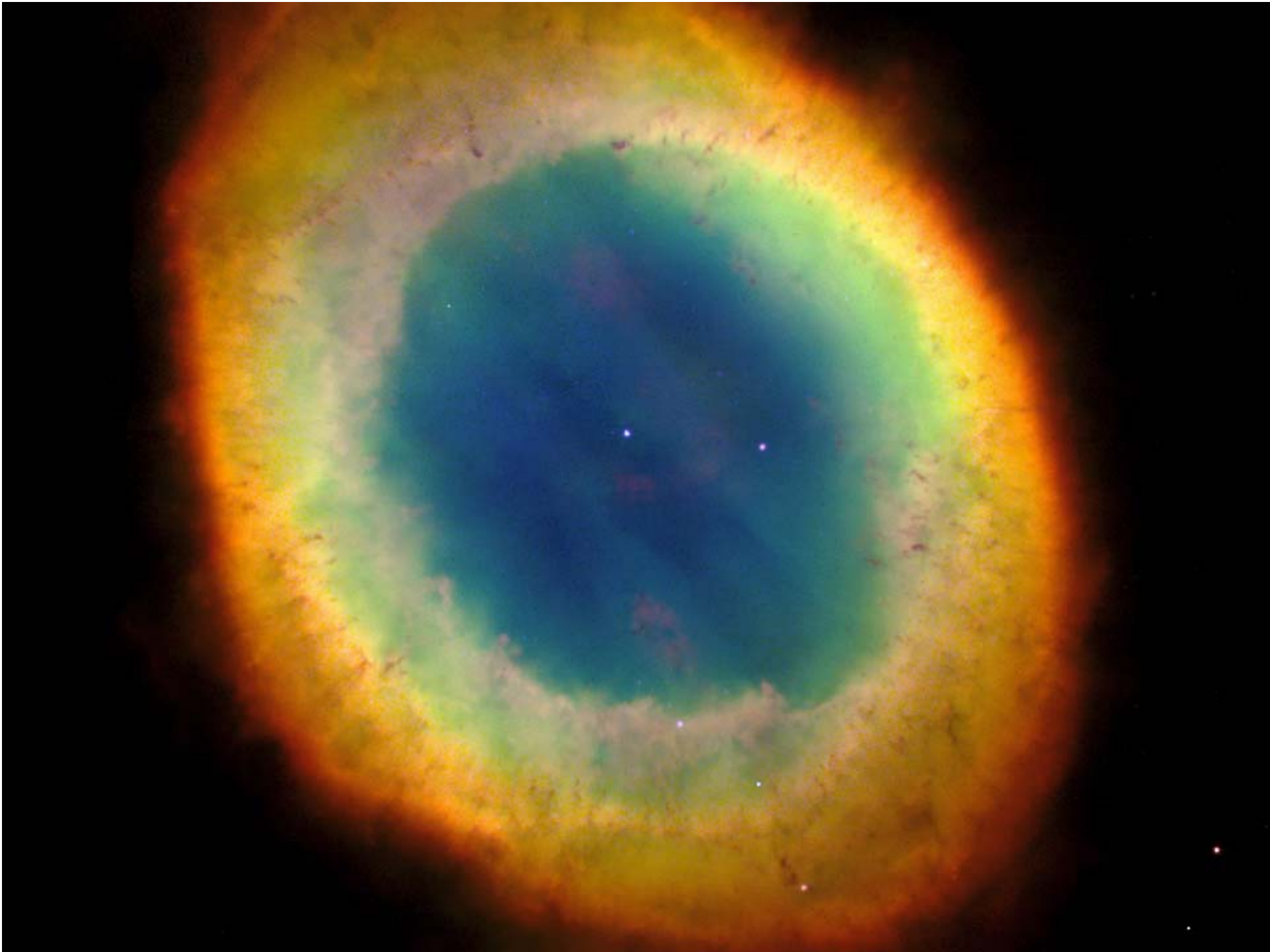
Surface of Sun



Earth



Sirius B  
(white dwarf)





Planetary Nebula NGC 3132



Hubble  
Heritage

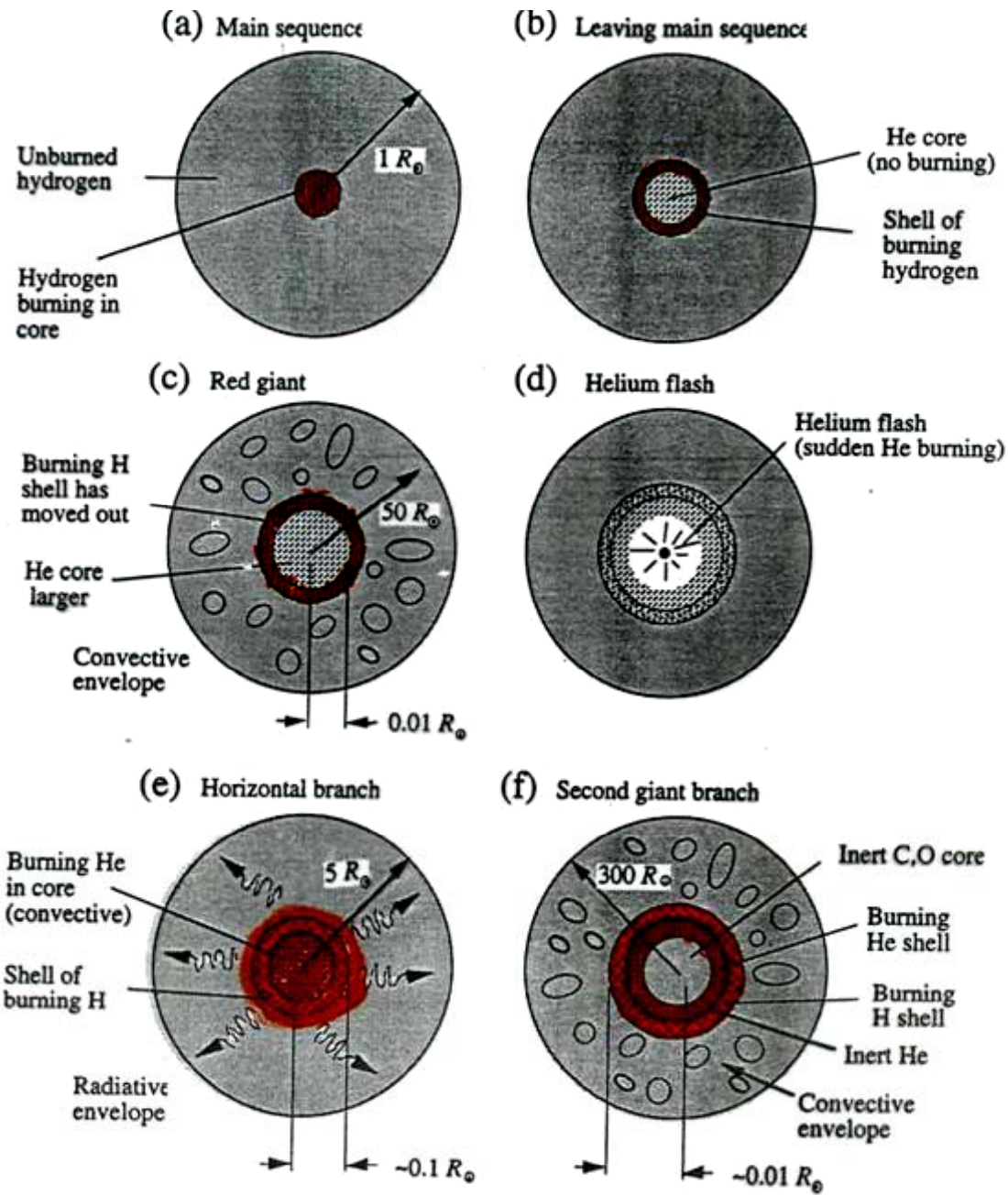
**Table 1.2: Properties of 3 Main Seq. Stars**

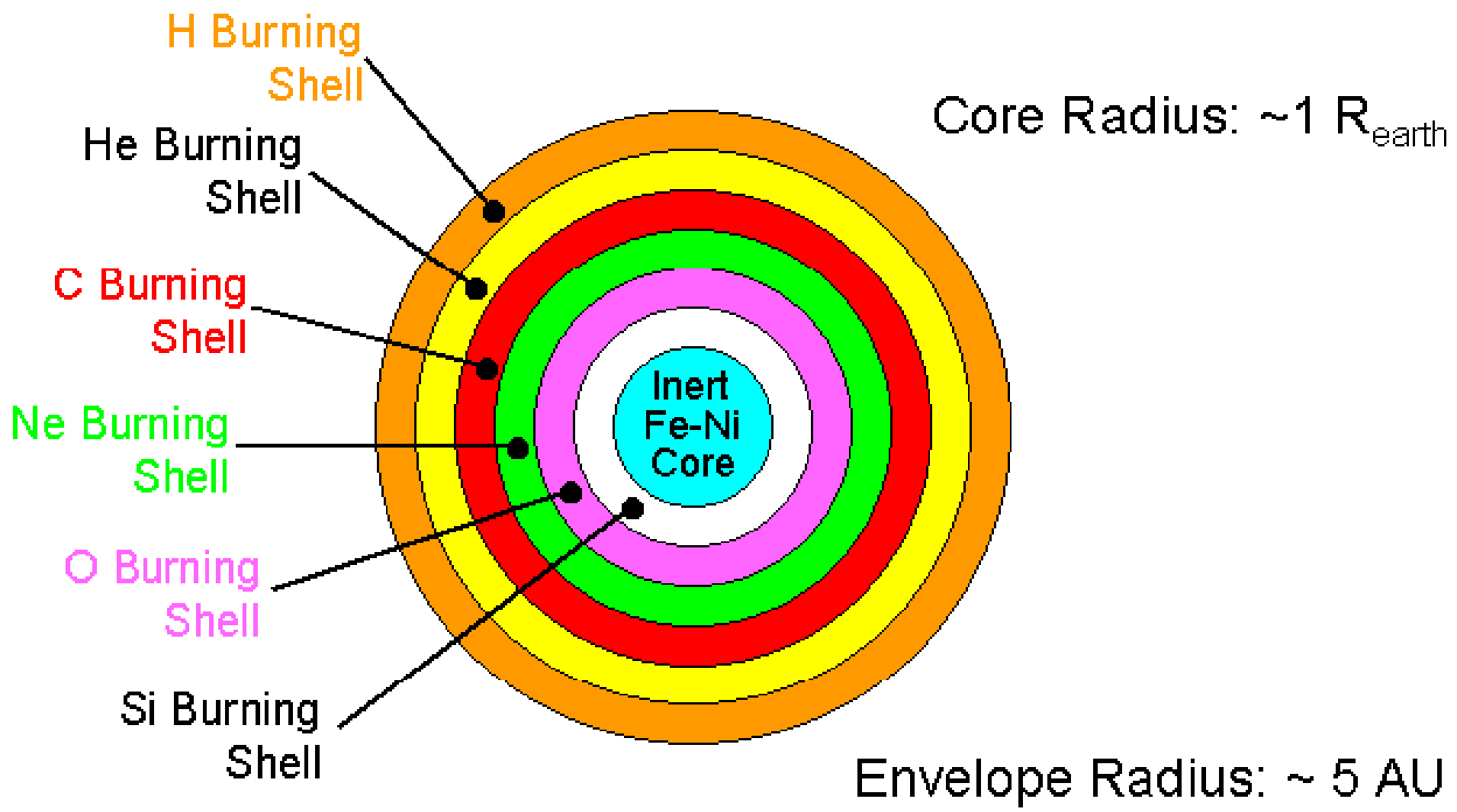
<i>Table 1.2</i>			
<i>Properties of 3 Main Sequence Stars</i>			
Property	M8V	G2 V (sun)	O5V
Mass <sup>1</sup>	$M_{\odot}/10$	$2.0 \times 10^{30}$ kg	$40 M_{\odot}$
Radius <sup>1</sup>	$R_{\odot}/8$	$7.0 \times 10^8$ m	$18 R_{\odot}$
Luminosity <sup>1</sup>	$L_{\odot}/1300$	$3.8 \times 10^{26}$ W	$5 \times 10^5 L_{\odot}$
Lifetime on main sequence <sup>2</sup>	$10^{13}$ y	$10^{10}$ y	$10^6$ y
Effective temperature $T_{eff}$ (K)	2 700 K	5770 K	40 000 K
Absolute visual magnitude, $M_V$	+16	+4.83	-5.8
Absolute bolometric mag., $M_{bol}$ <sup>3</sup>	~+12	+4.75	~-10
Apparent visual magnitude, $m_V$	-	-26.74	-
Color: frequency of peak power	IR	Yellow	UV
Color Index, $B-V \equiv m_B - m_V$	+1.8	+0.65	-0.35
Color Index, $U-B$	-	+0.13	-1.15

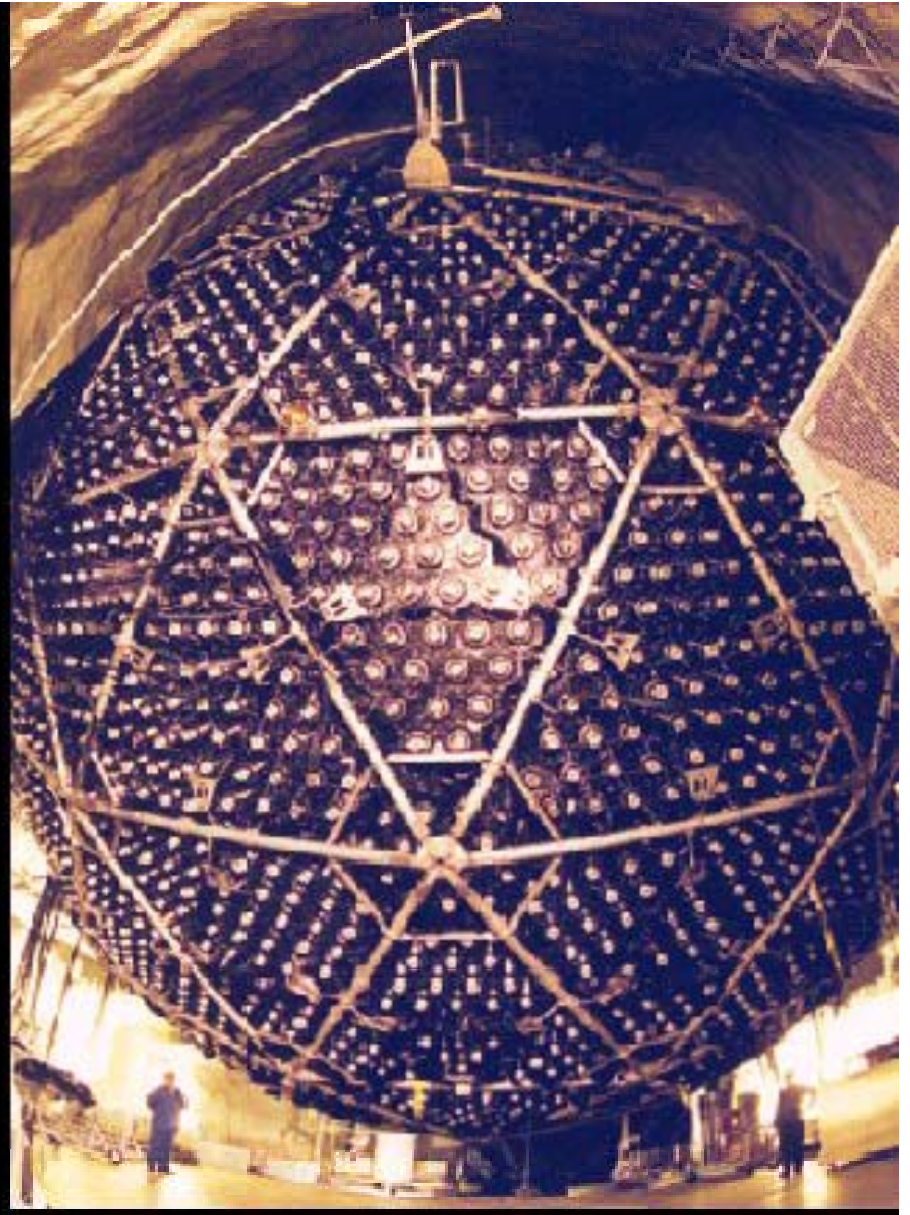
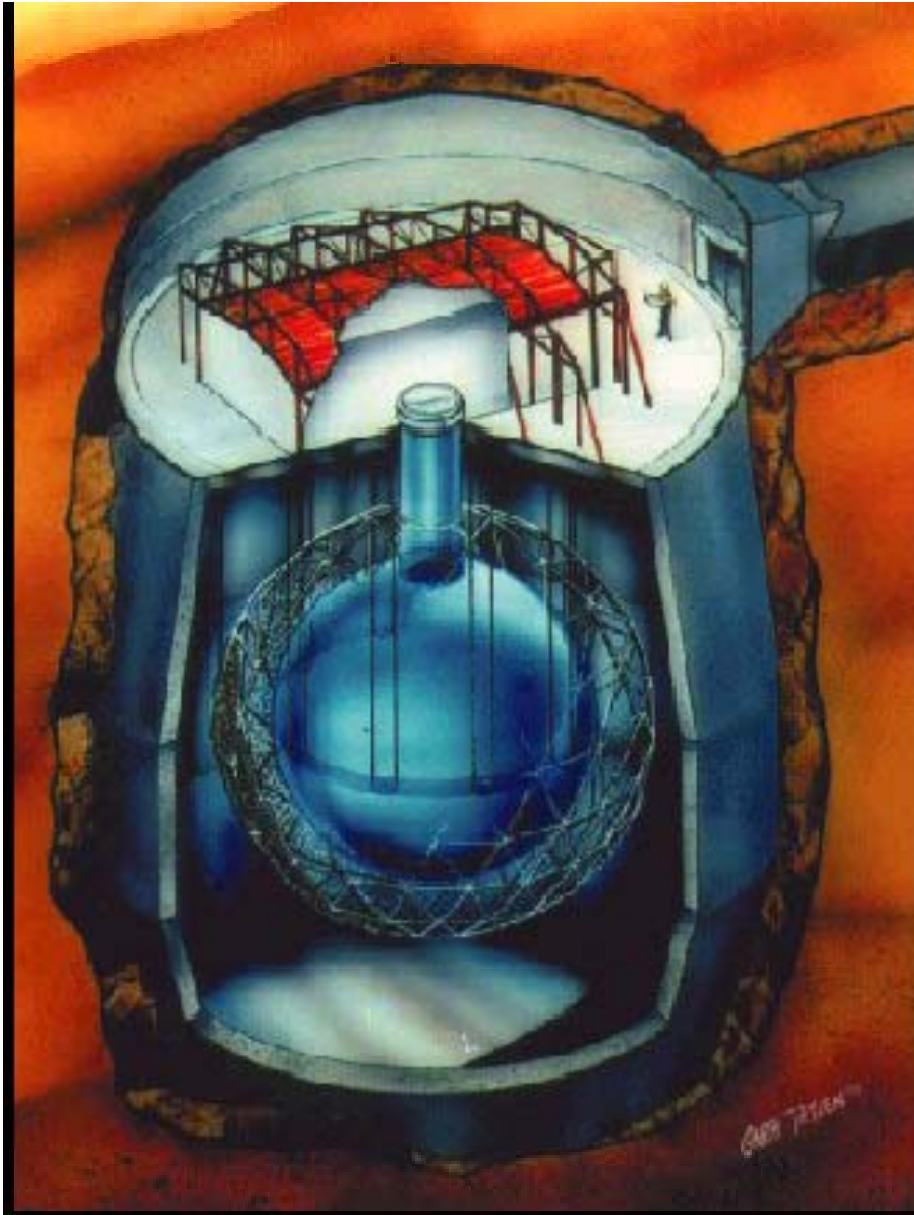
<sup>1</sup> The symbols  $M_{\odot}$ ,  $R_{\odot}$ , and  $L_{\odot}$  are the solar values.

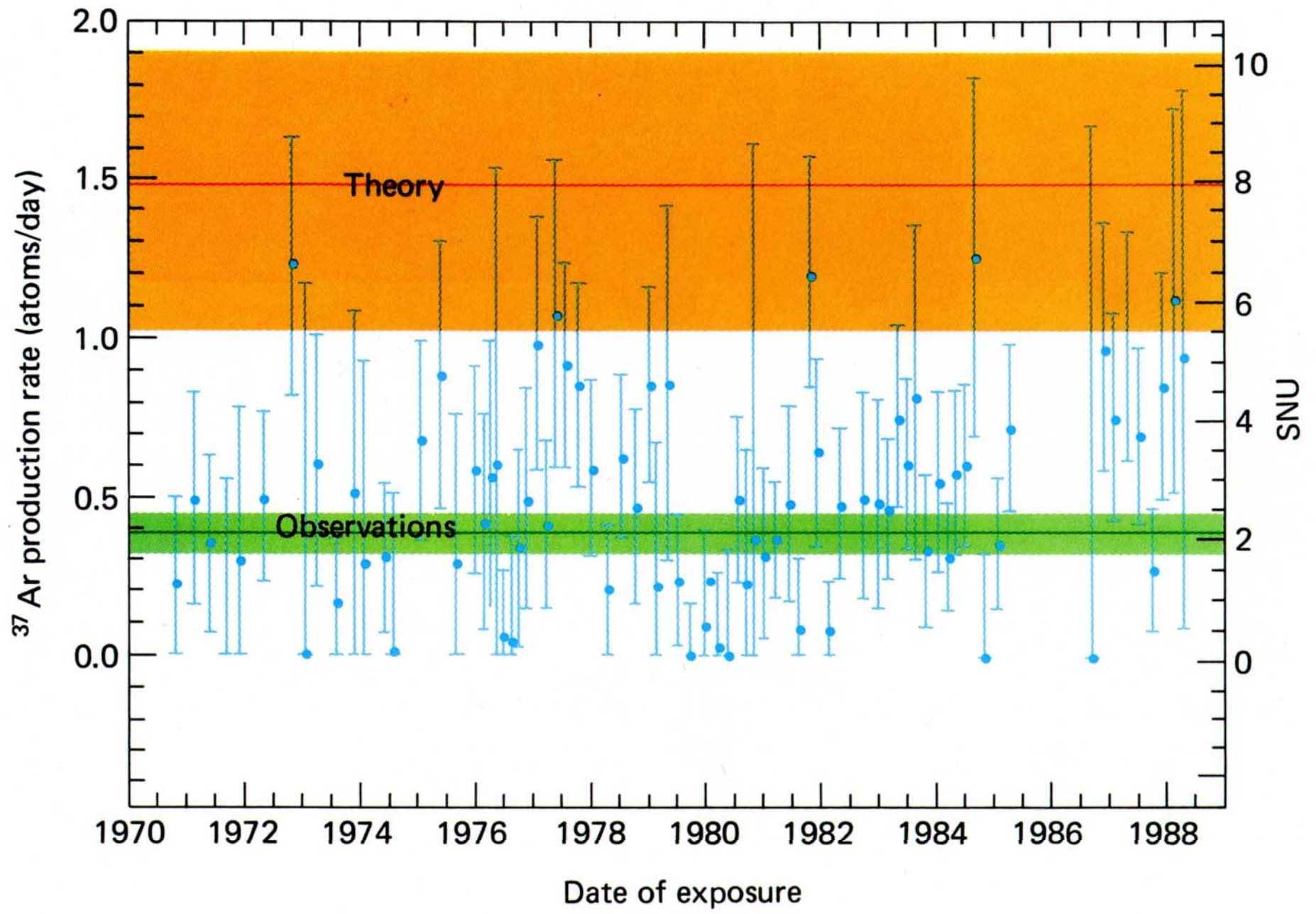
<sup>2</sup> Time during the stable hydrogen-burning phase of the star's life.

<sup>3</sup> The luminosity of a  $M_{bol} = 0$  star is  $3.0 \times 10^{28}$  W.

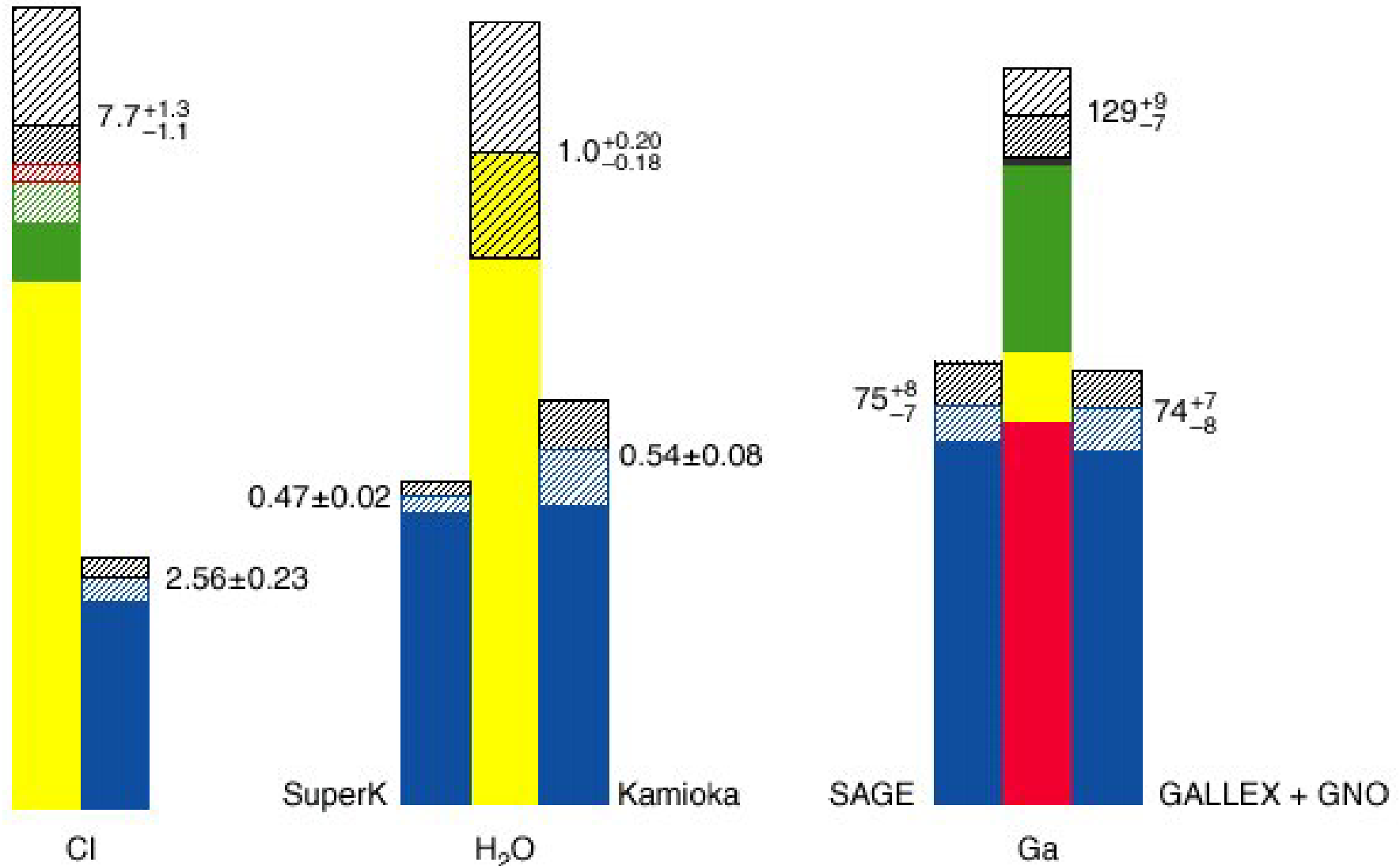






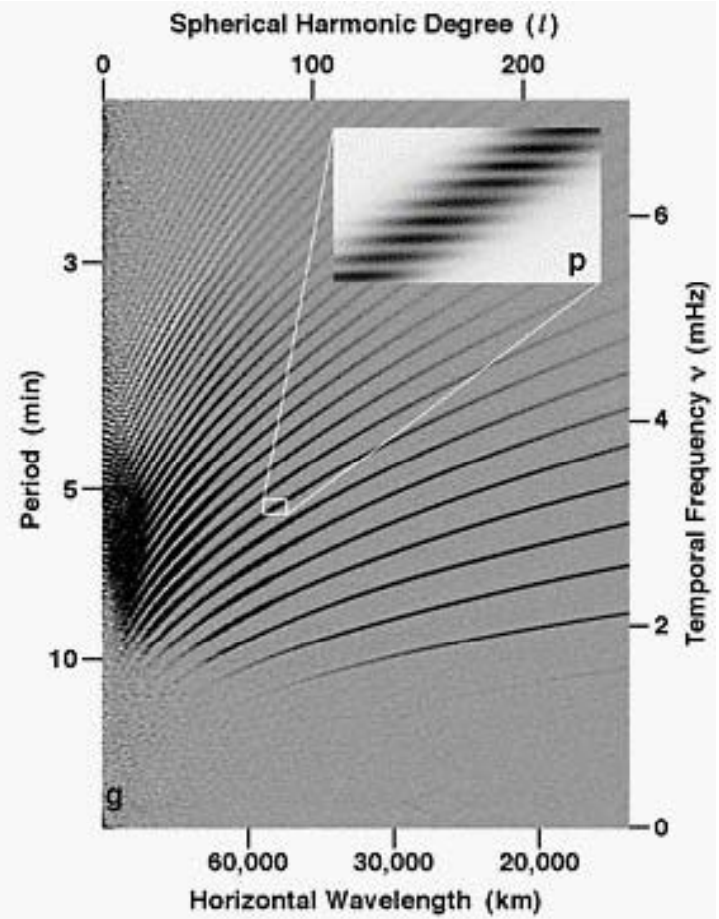
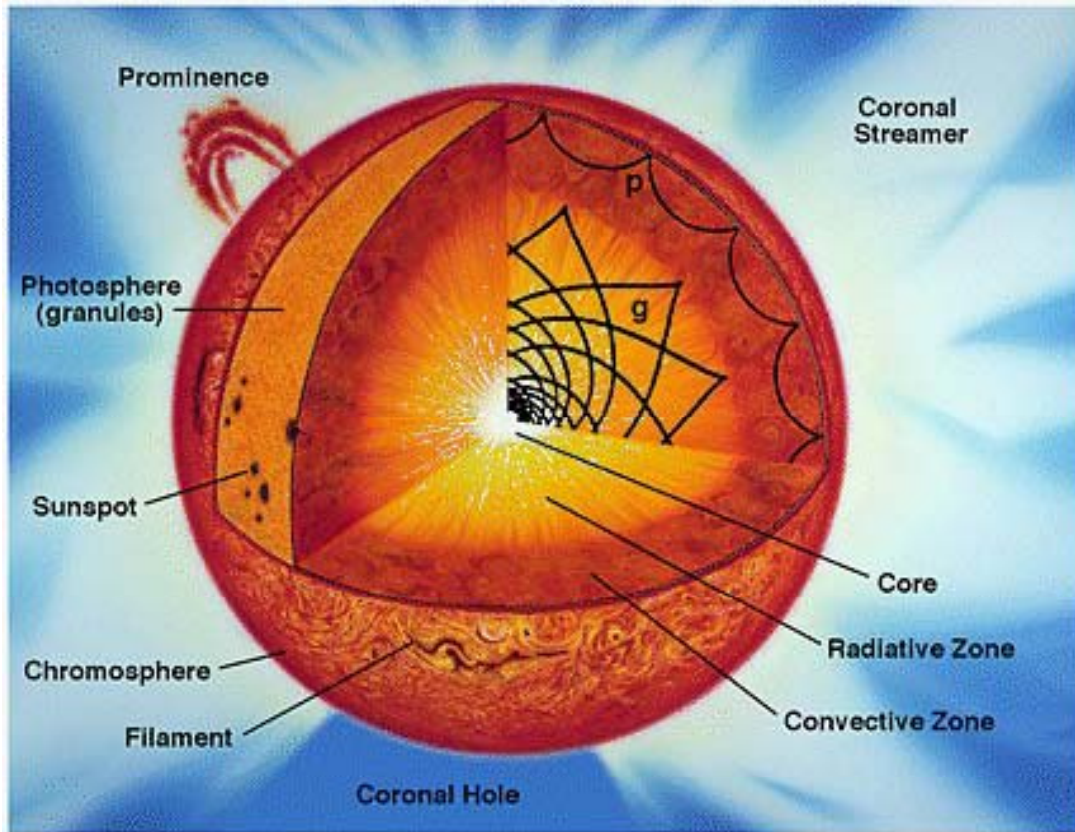


**Total Rates: Standard Model vs. Experiment**  
Bahcall-Pinsonneault 2000



Theory ■ <sup>7</sup>Be ■ p-p, pep ■ Experiments

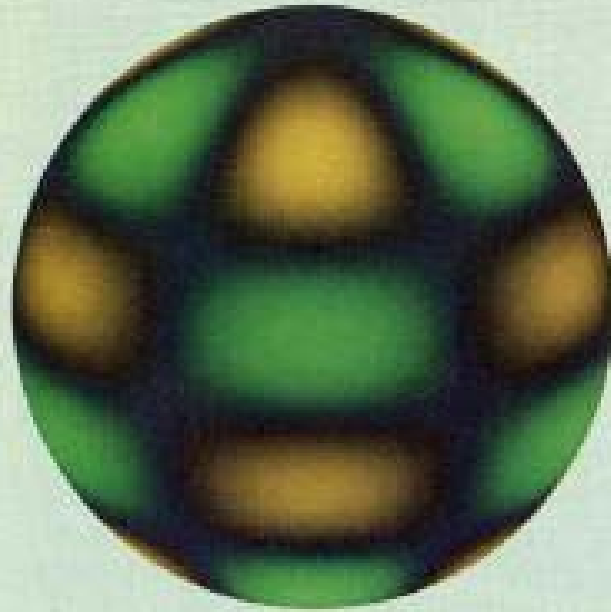
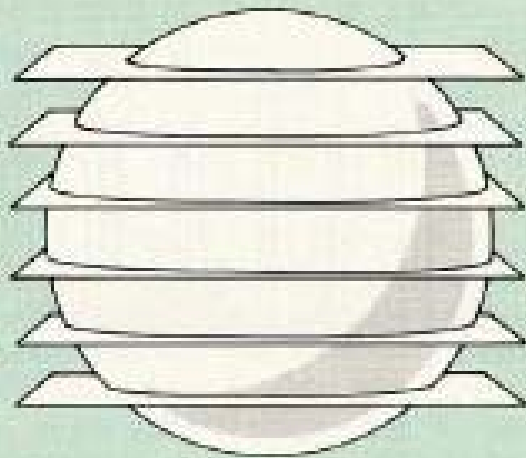
■ <sup>8</sup>B ■ CNO



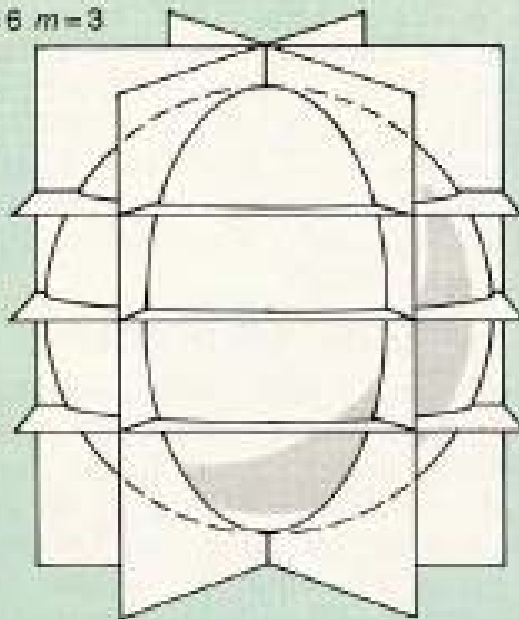




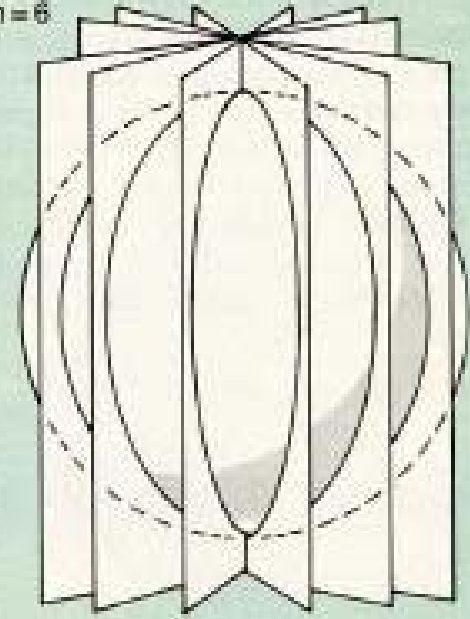
$l=6, m=0$

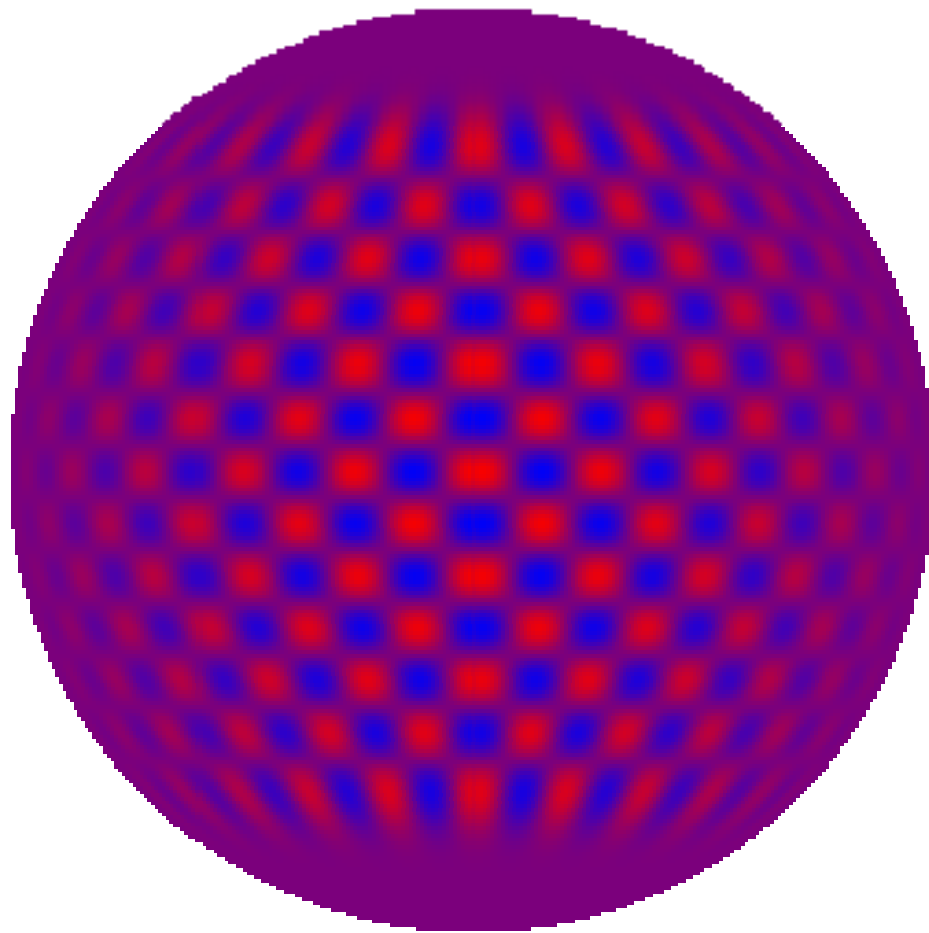


$l=6, m=3$



$l=6, m=6$







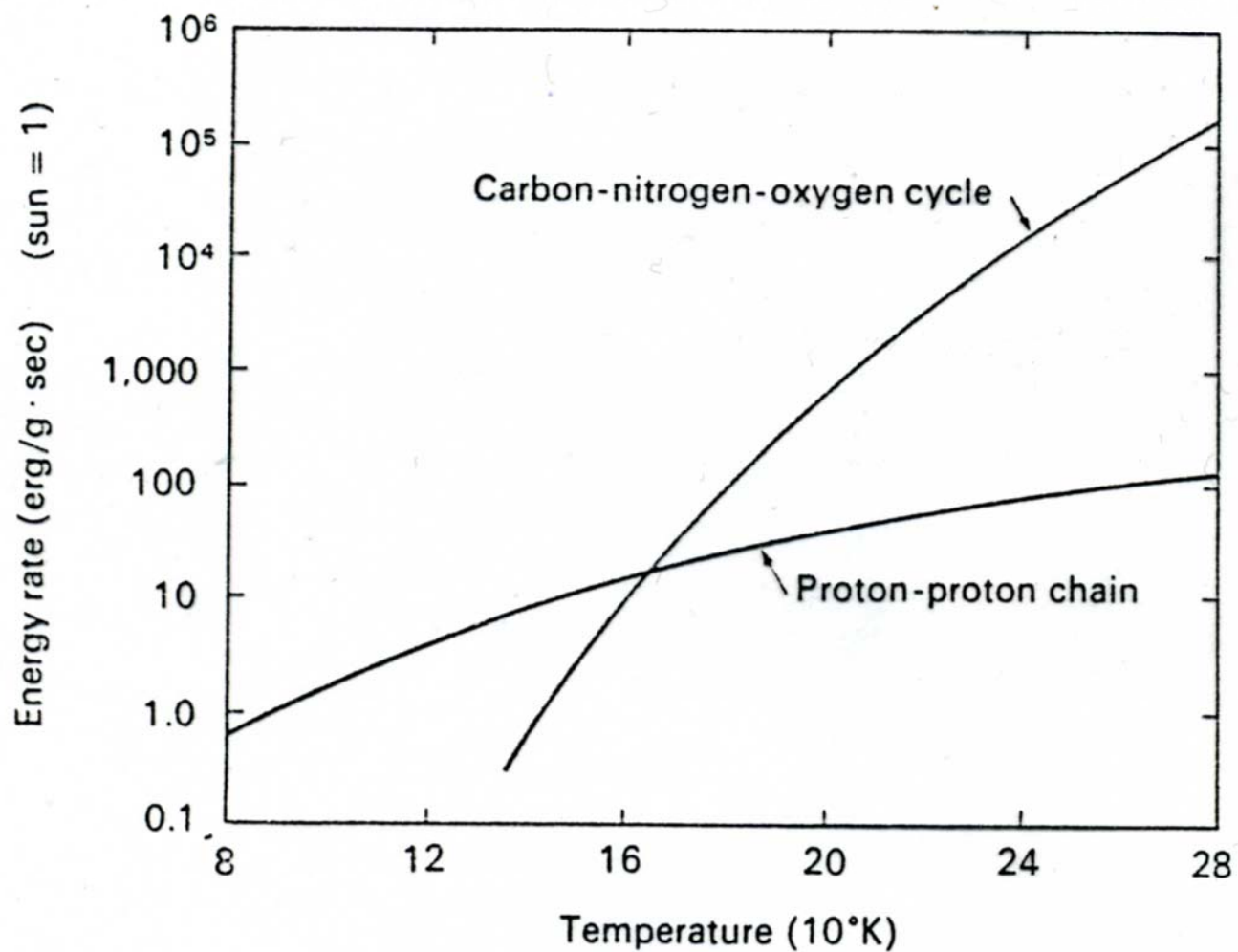


Figure 12.4 Stellar energy-production rates (after H. Bethe and H. Reeves.)

