



Cosmic Connections: An Introduction to Astronomy and Maine's Magnificent Night Skies

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Unit 9

Our Sun: The Living Star

Our Solar System

Radius (km):	2,440	6,052	6,371	3,389	69,911	58,232	25,362	24,622
Earth mass:	5.5%	81.5%	100%	10.7%	x317.8	x95.2	x14.5	x17.1
Orbit (earth time):	88days	224.7days	365.25days	1.9yrs	11.9 yrs	29.5yrs	84yrs	164.8yrs

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune

Luna

Radius (km):	1,737
Earth mass %:	1.2
Orbit (earth days):	27.3

Asteroid Belt

Ceres

Radius (km):	476
Luna mass %:	0.015
Orbit (earth yrs):	4.6

Pluto Haumea Makemake Eris

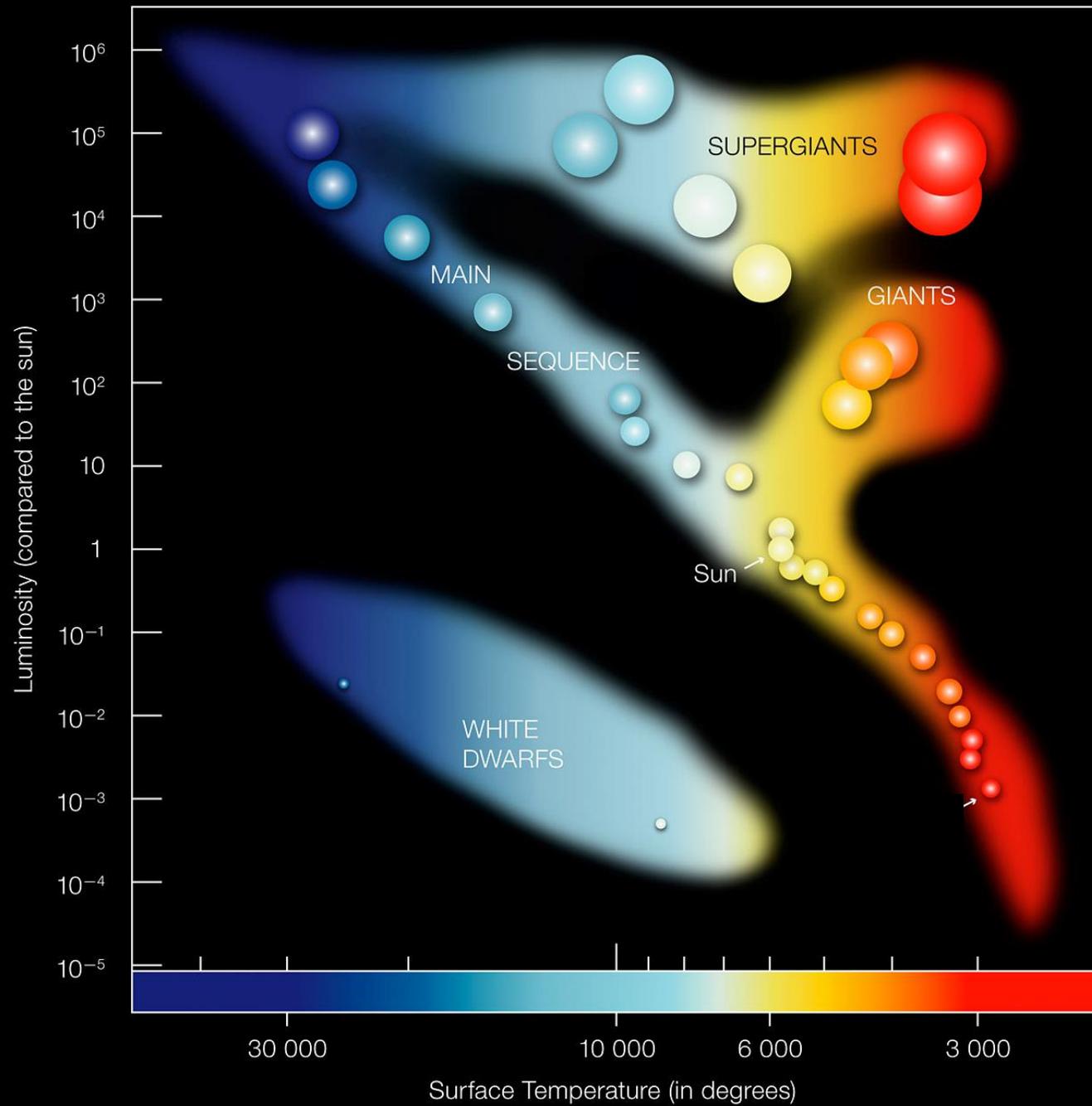
Radius (km):	1,187	~620	~715	1,163
Earth mass %:	17.8	5.4	?	23
Orbit (earth yrs):	247.7	284.1	309.1	558

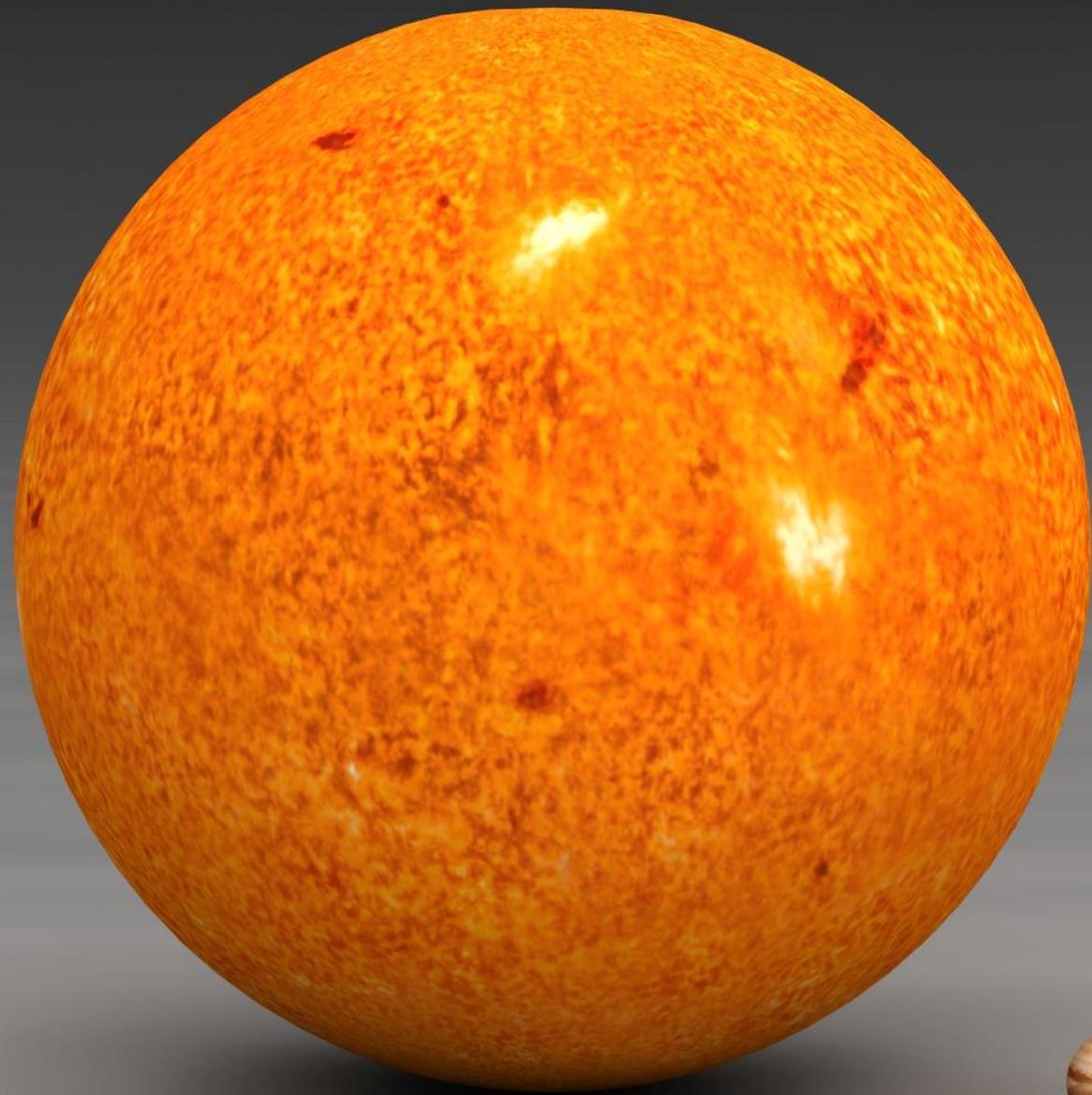
← Planets

← Dwarf
Planets

Orbit distances from the Sun in billions of km







In one hour the Earth receives

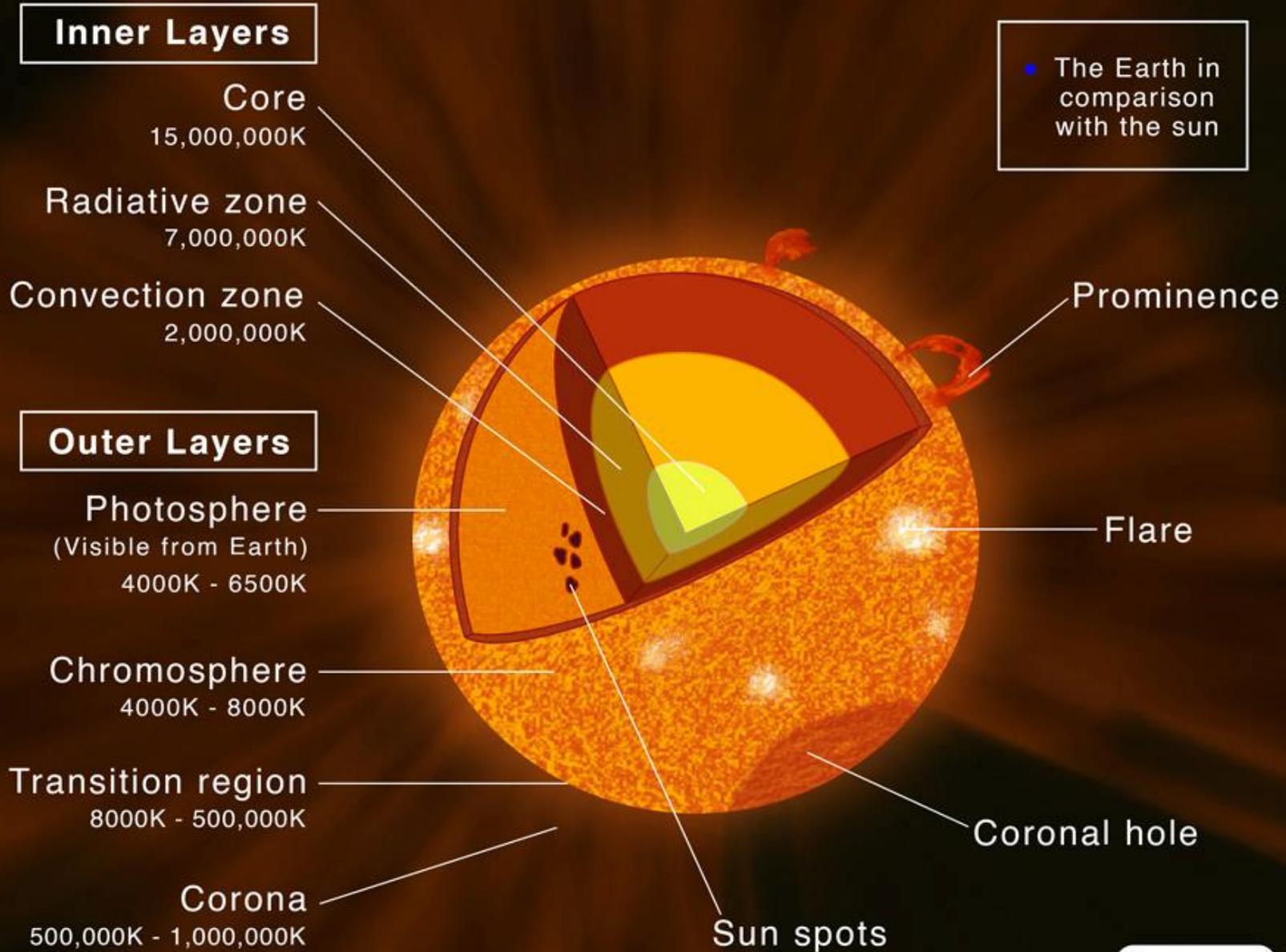
173 000 TWh of energy from the Sun.

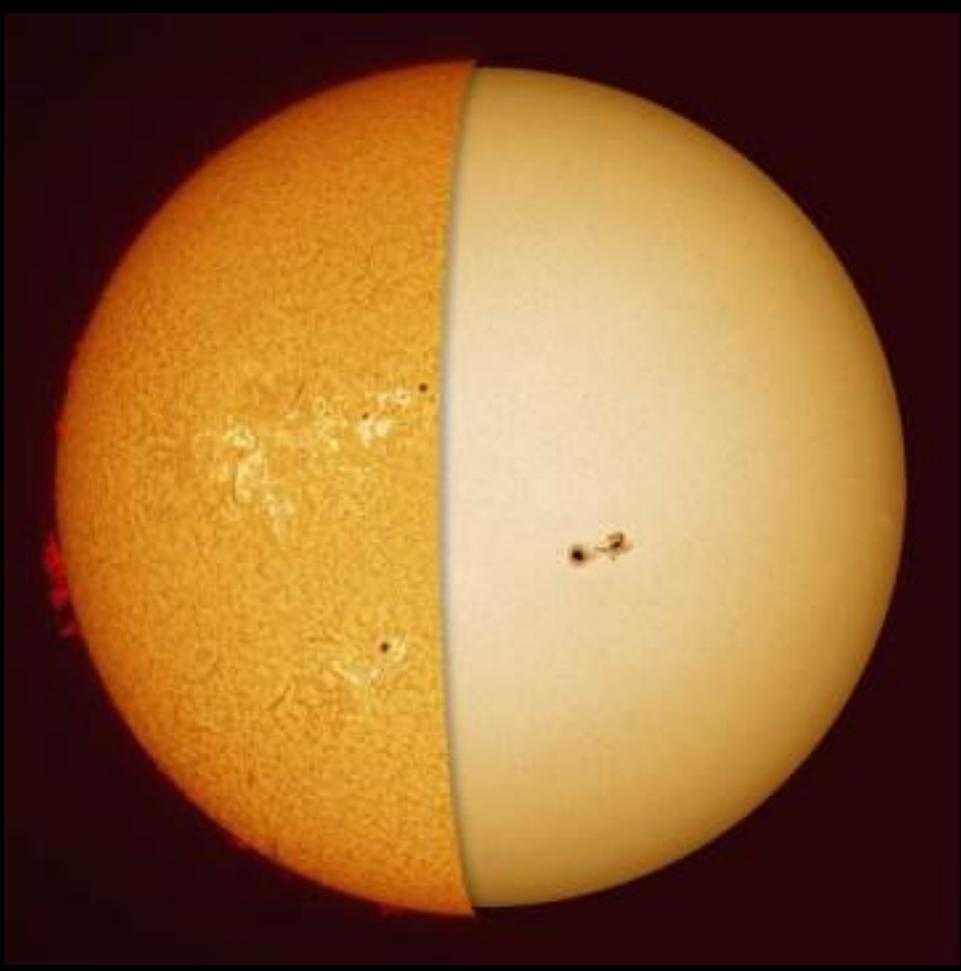
During the year 2017 humanity consumed

160 000 TWh of energy.

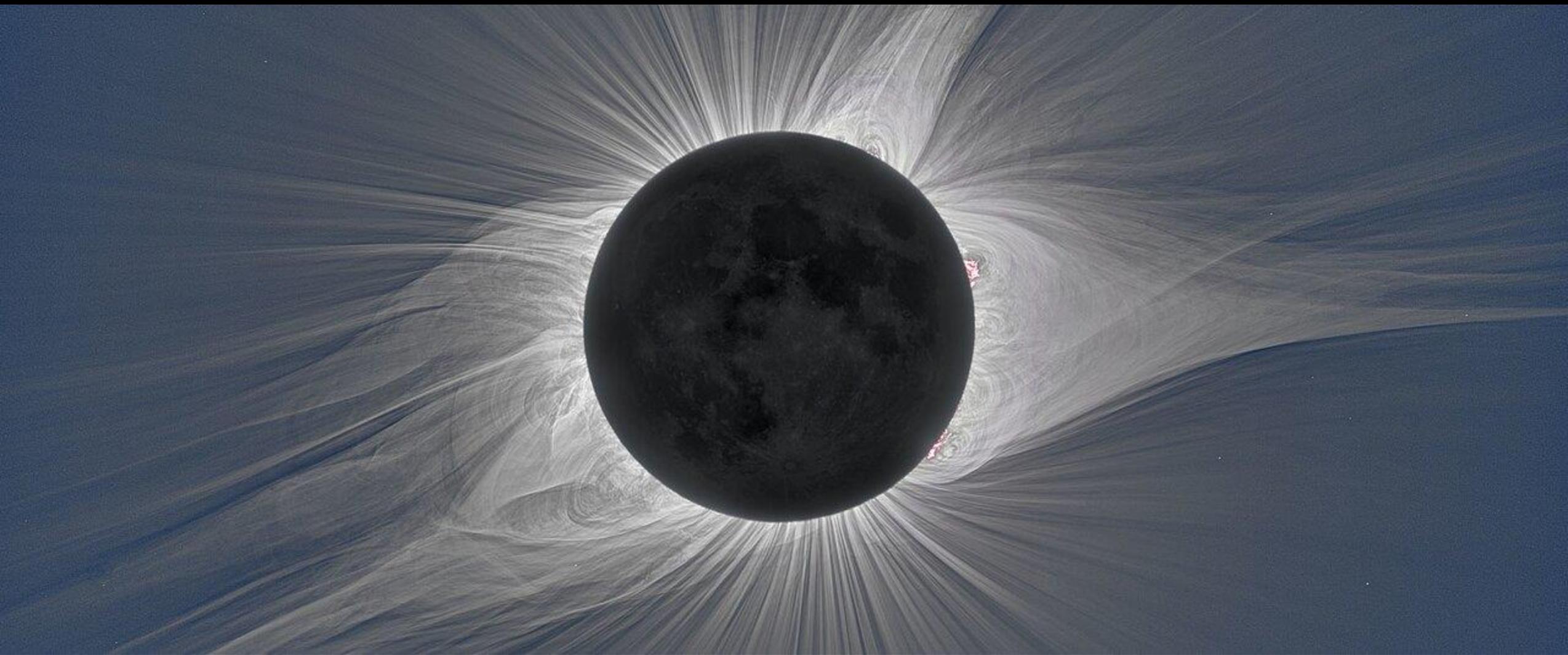
Earth receives only 0.000000045% of Sun's energy!

Layers of the Sun









Sun

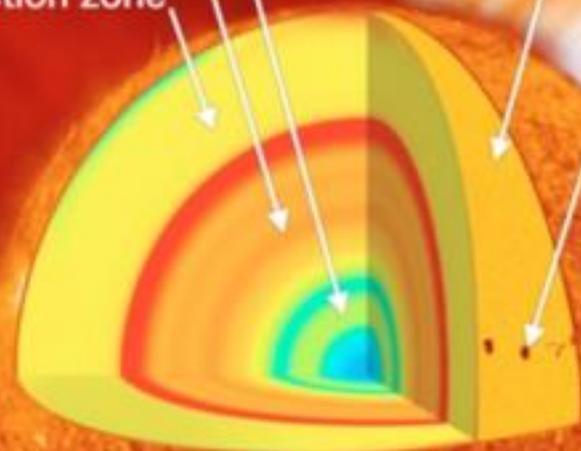
Earth

Internal Structure:

- inner core
- radiative zone
- convection zone

photosphere

sunspot



plage

coronal mass ejection

corona

magnetosphere

polar cusp

incoming solar wind particles

plasmasphere

atmosphere

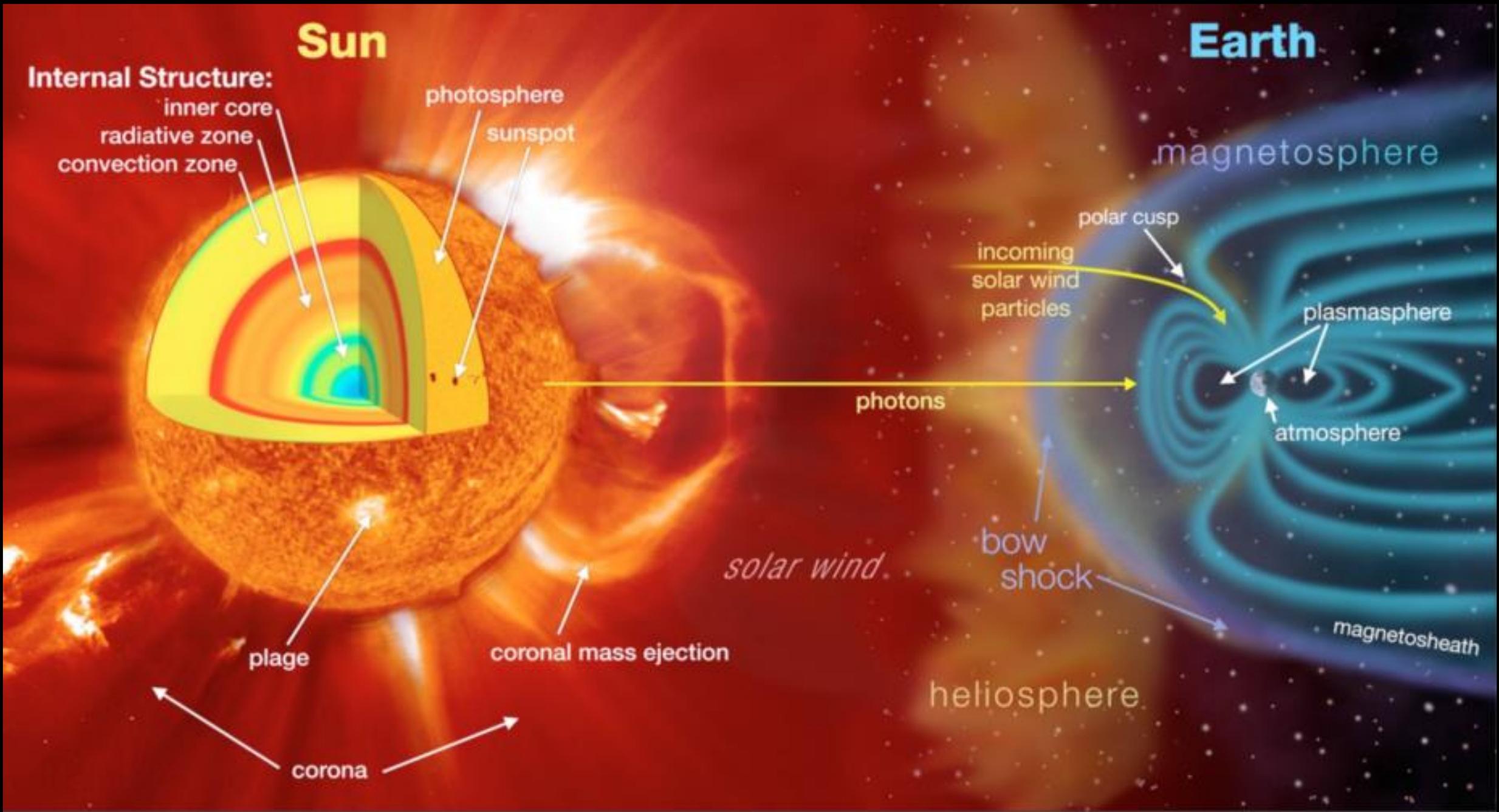
photons

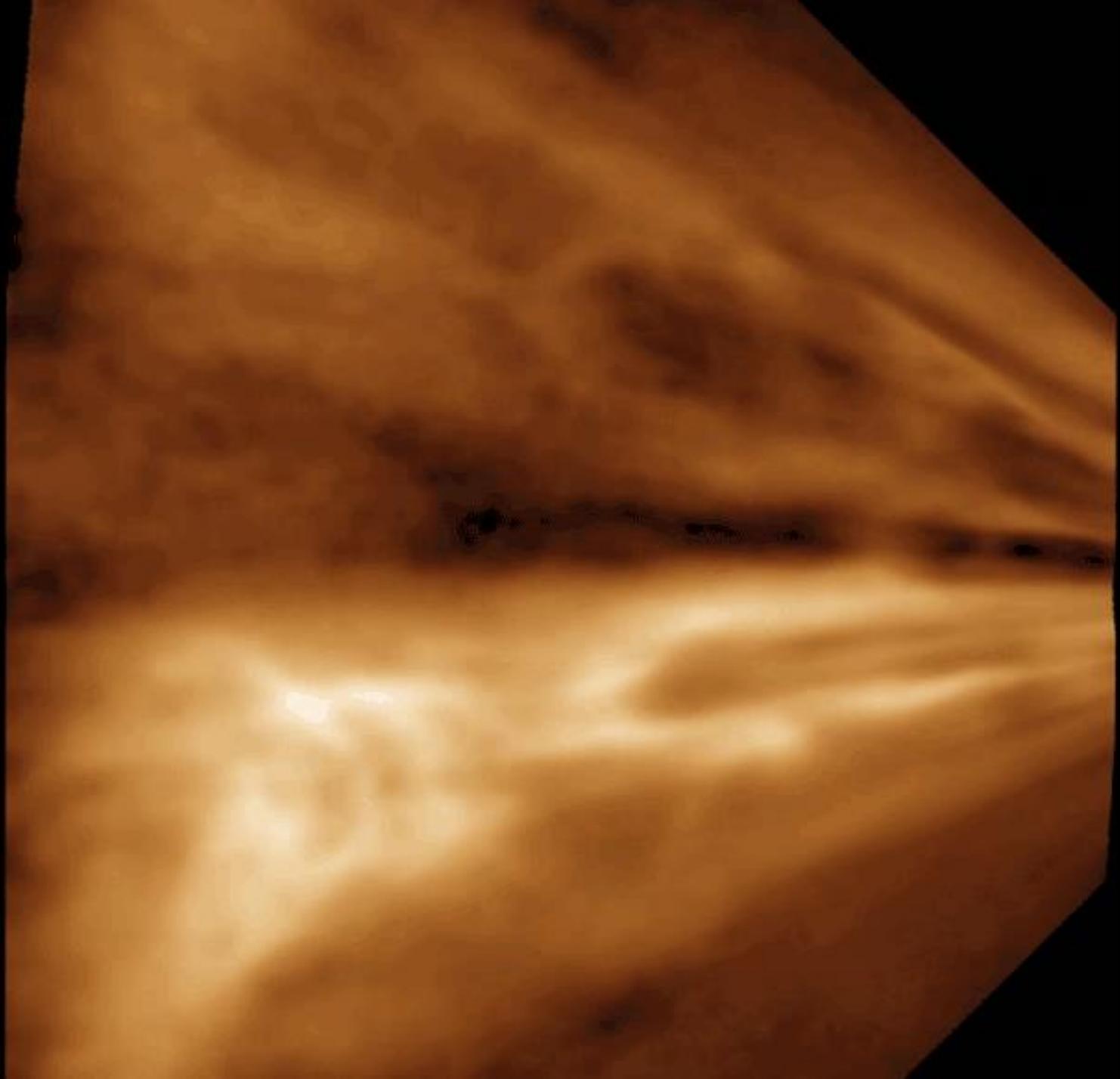
bow shock

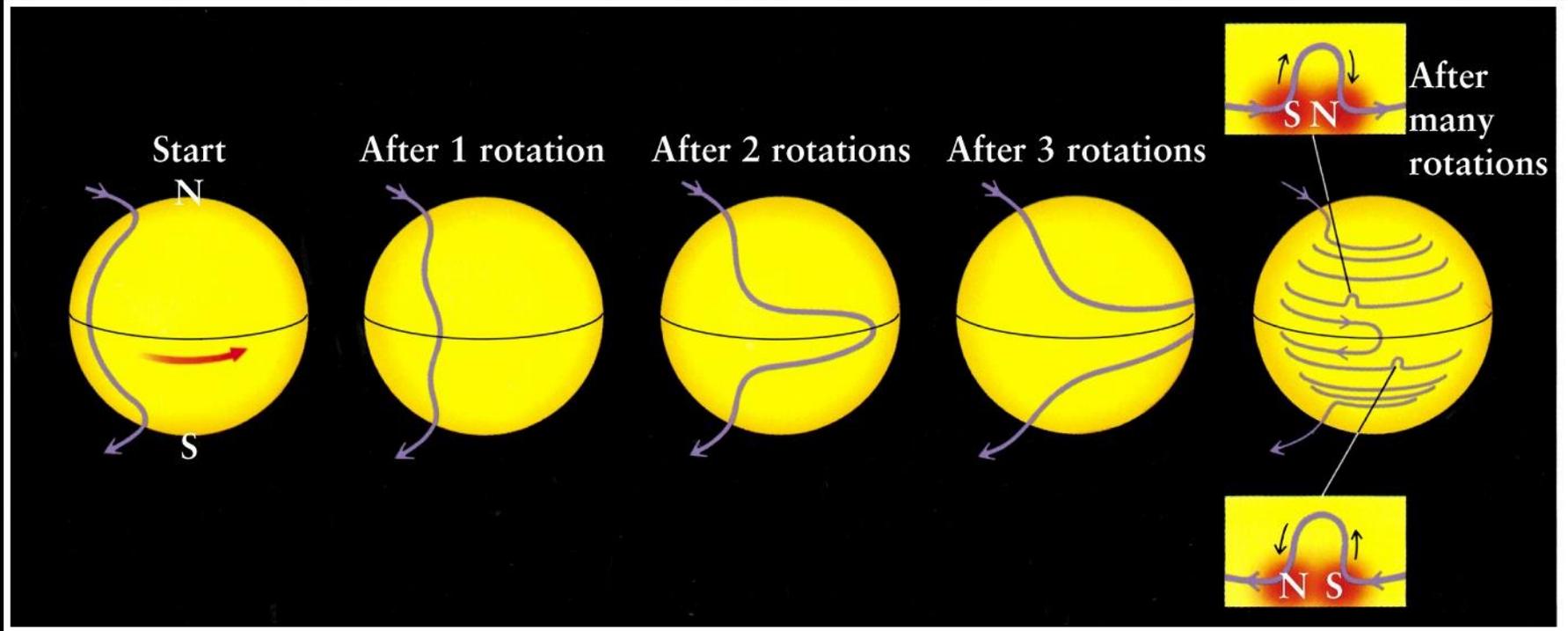
magnetosheath

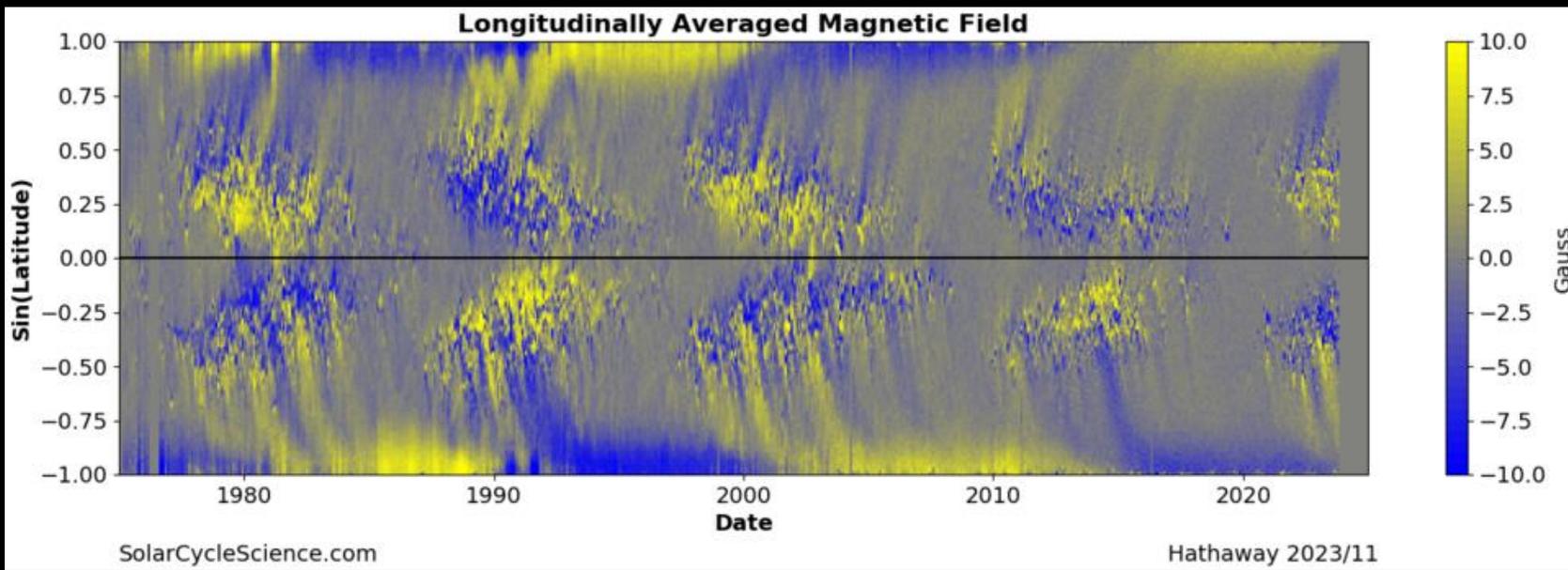
solar wind

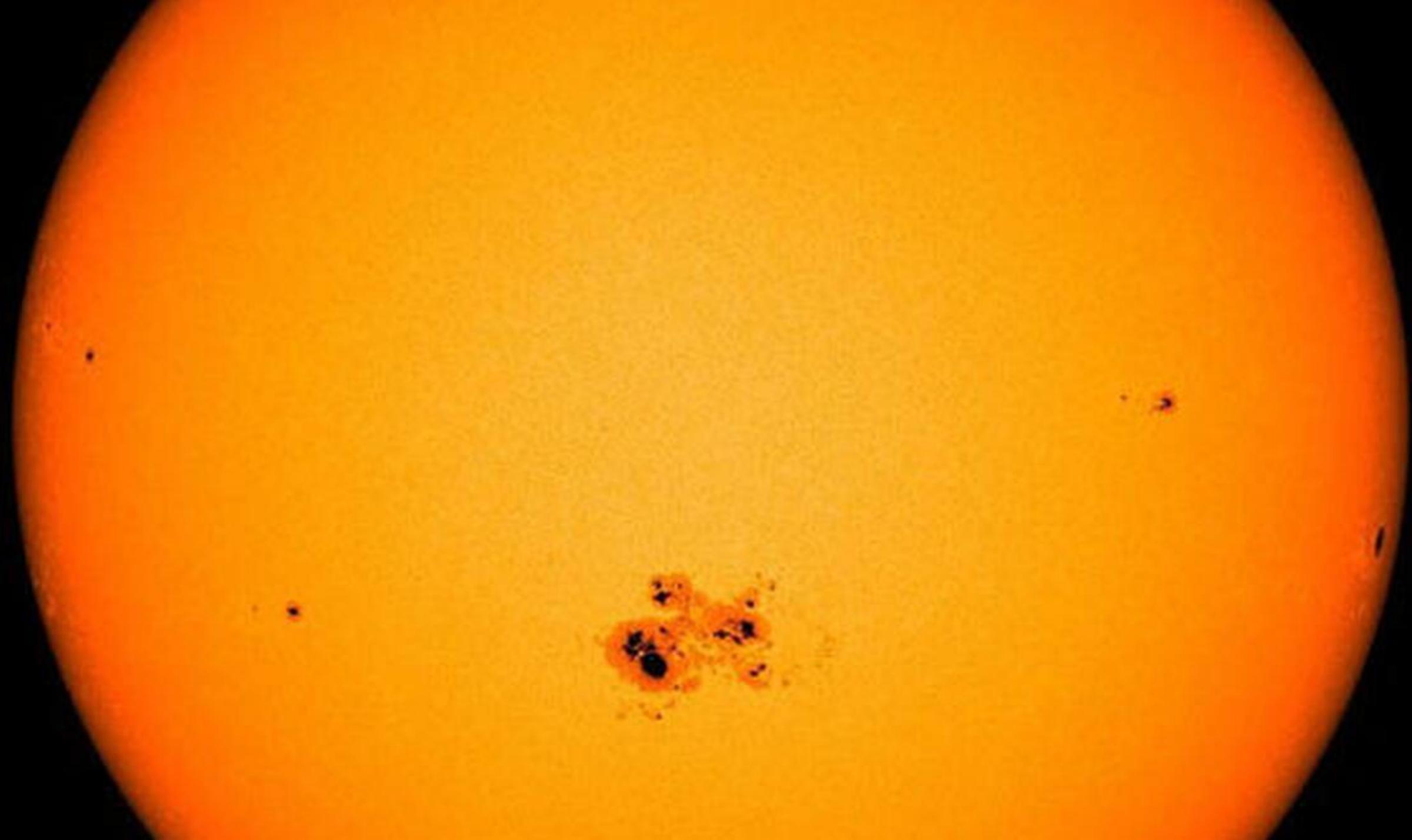
heliosphere

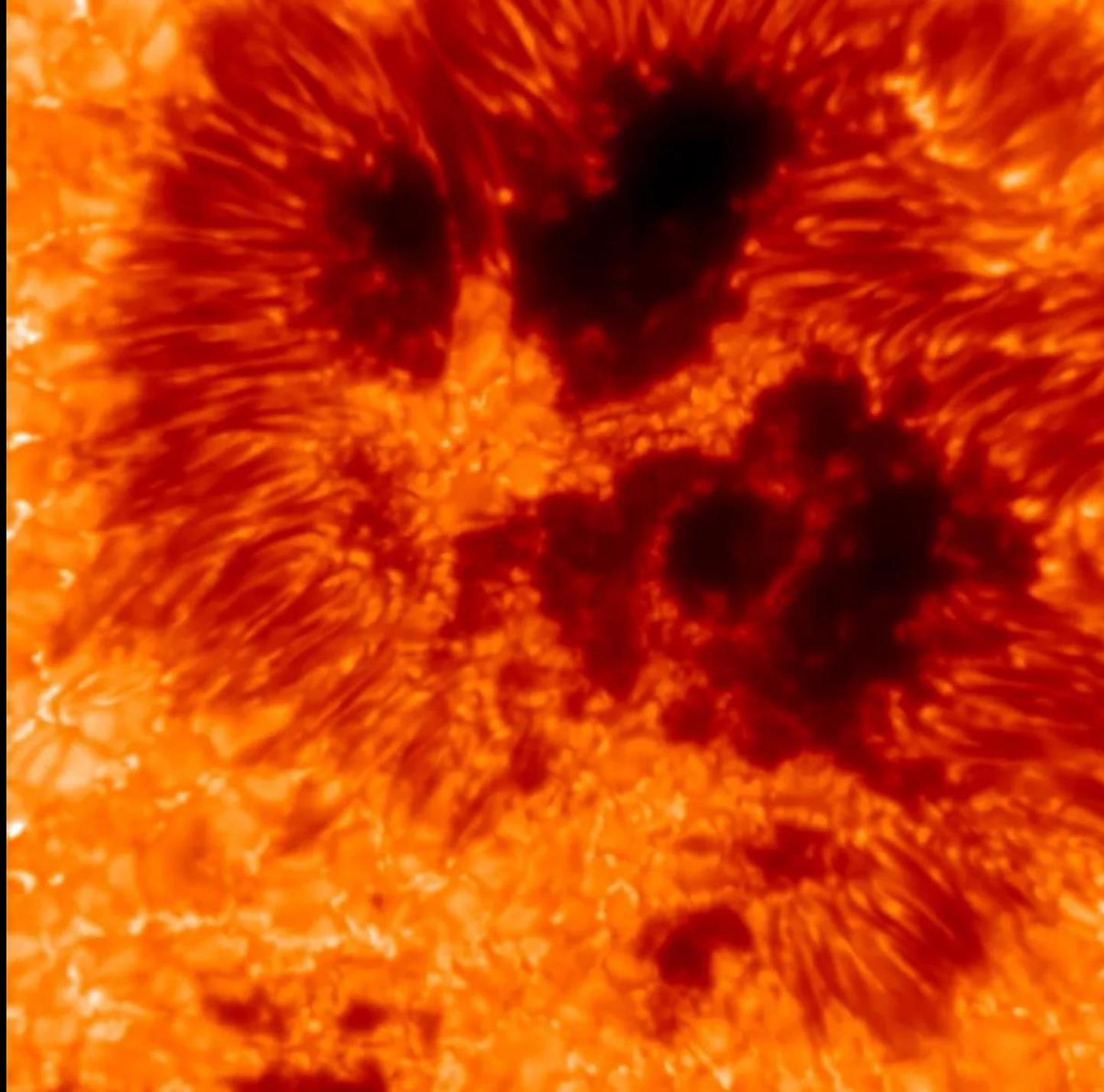












PLASMA AND THE MAGNETIC FIELDS

magnetic field lines



$T = 5,800K$

$T = 5,800K$

sunspot pair
 $T = 4,500K$

convection
cells

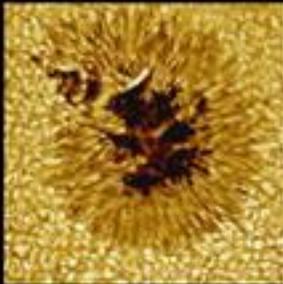




SOLAR FLARE: an enormous explosion on the surface of the sun that occurs when a buildup of magnetic energy in the sun's atmosphere is suddenly released. Flares occur near sunspots, on the dividing line between areas of opposite magnetic polarity.



CORONAL MASS EJECTION (CME): a huge bubble of gas erupting from the sun over the course of several hours. At the maximum point of the solar cycle there can be two or three CMEs per day.



SUNSPOT: an area on the sun's surface that appears dark because it is cooler than the surrounding areas. Sunspots are regions where the local magnetic field is very strong. The spots usually appear in pairs.

Giant by comparison

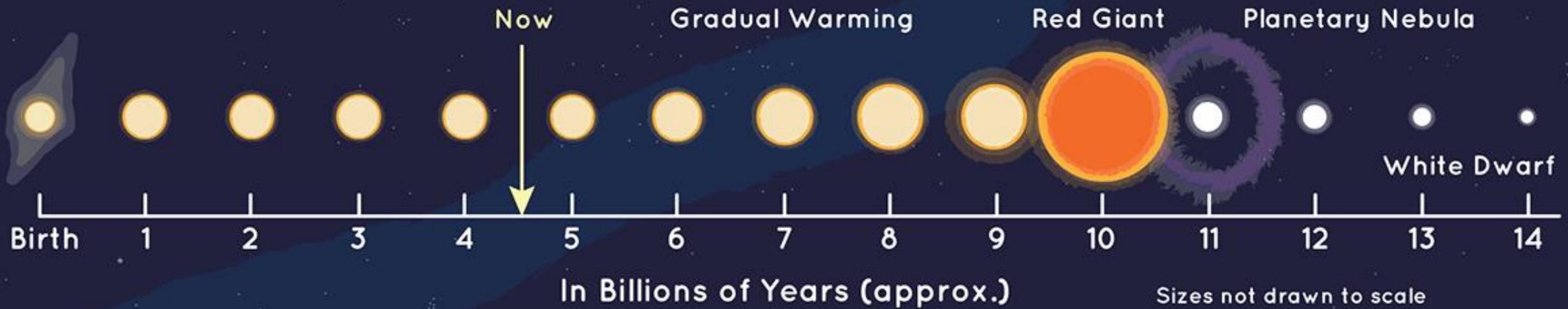
At 865,000 miles across (1,391,400 km), the sun is nearly 110 times the diameter of Earth.



[NASA: Many Views of a Massive CME, Coronal Mass Ejection](#)

<https://youtu.be/sg3NAdOYp8Q>

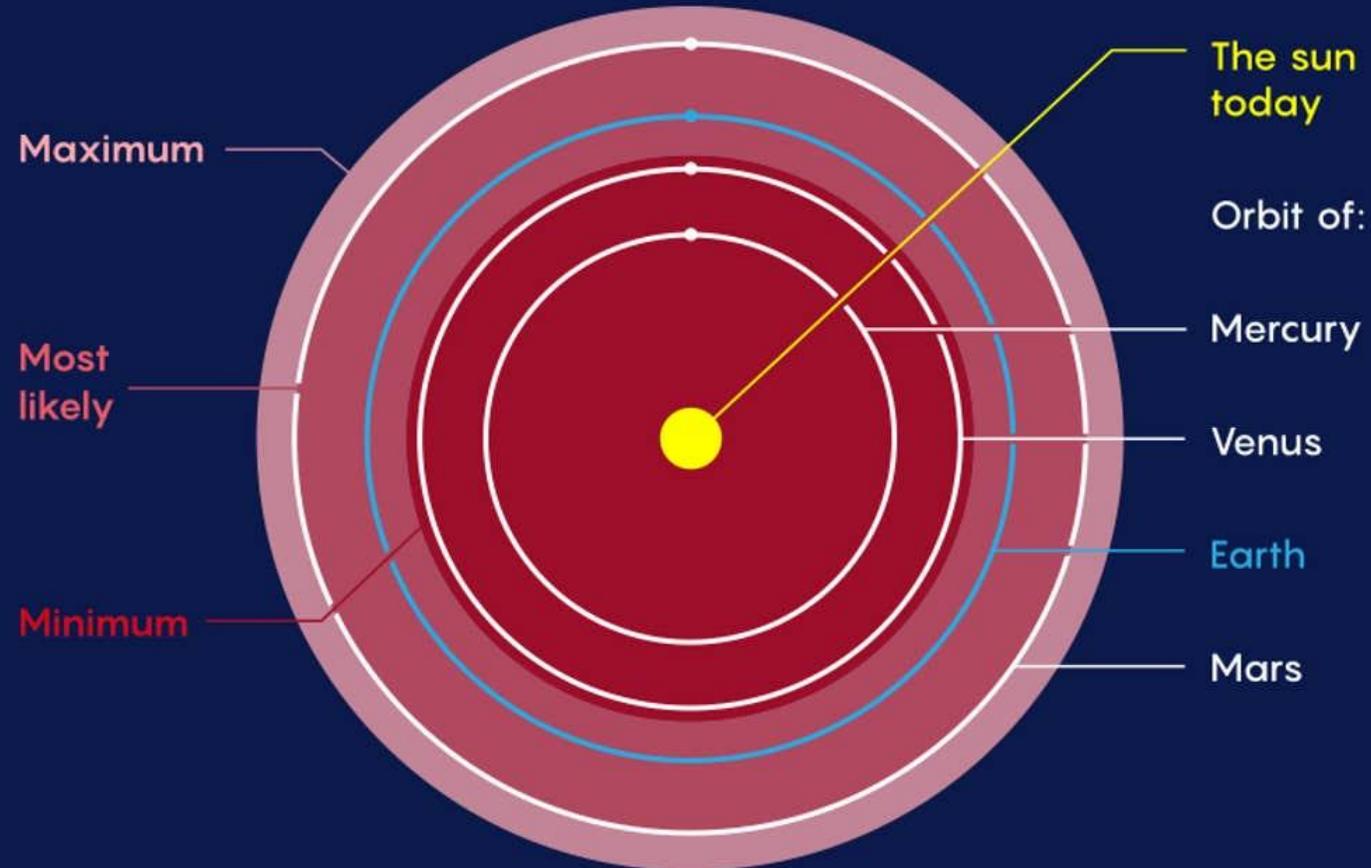
Life Cycle of the Sun



Death Star

Our aging sun will balloon into a red giant, threatening Earth's survival. But it isn't clear how big the star will become.

ESTIMATES OF THE SUN'S SIZE AS A RED GIANT



Solar Eclipse Eye Safety



Not Safe

Do not wear ordinary or polarized sunglasses. They are not strong enough to protect your eyes.



Safe

Use glasses specially designed for solar eclipse viewing to block the sun's harmful rays



Not Safe

Do not use solar eclipse glasses to look through a camera, binoculars, or a telescope.



Safe

Use only specially designed filters for lenses.

