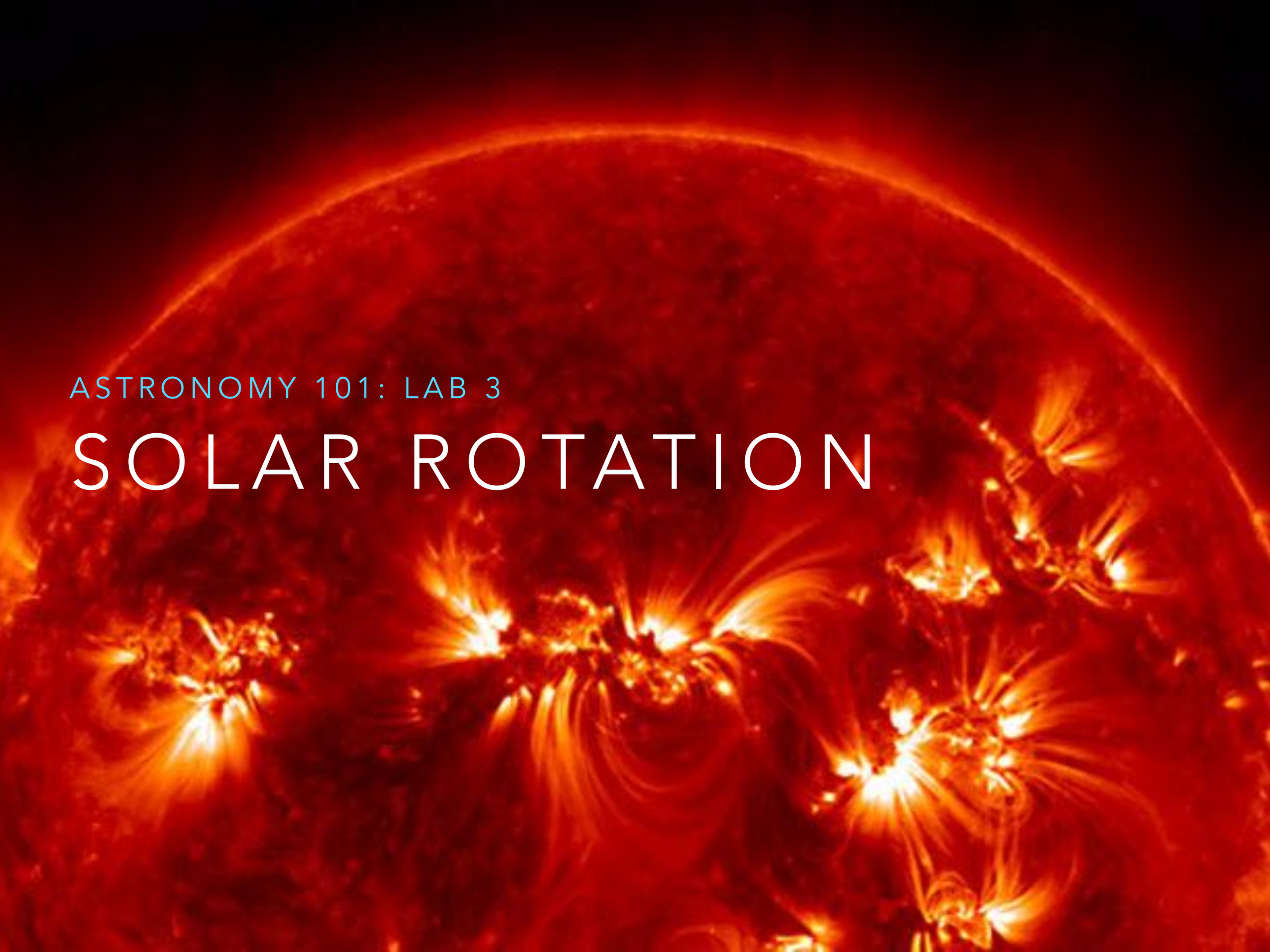
ASTRONOMY 101: LAB 3

SOLAR ROTATION



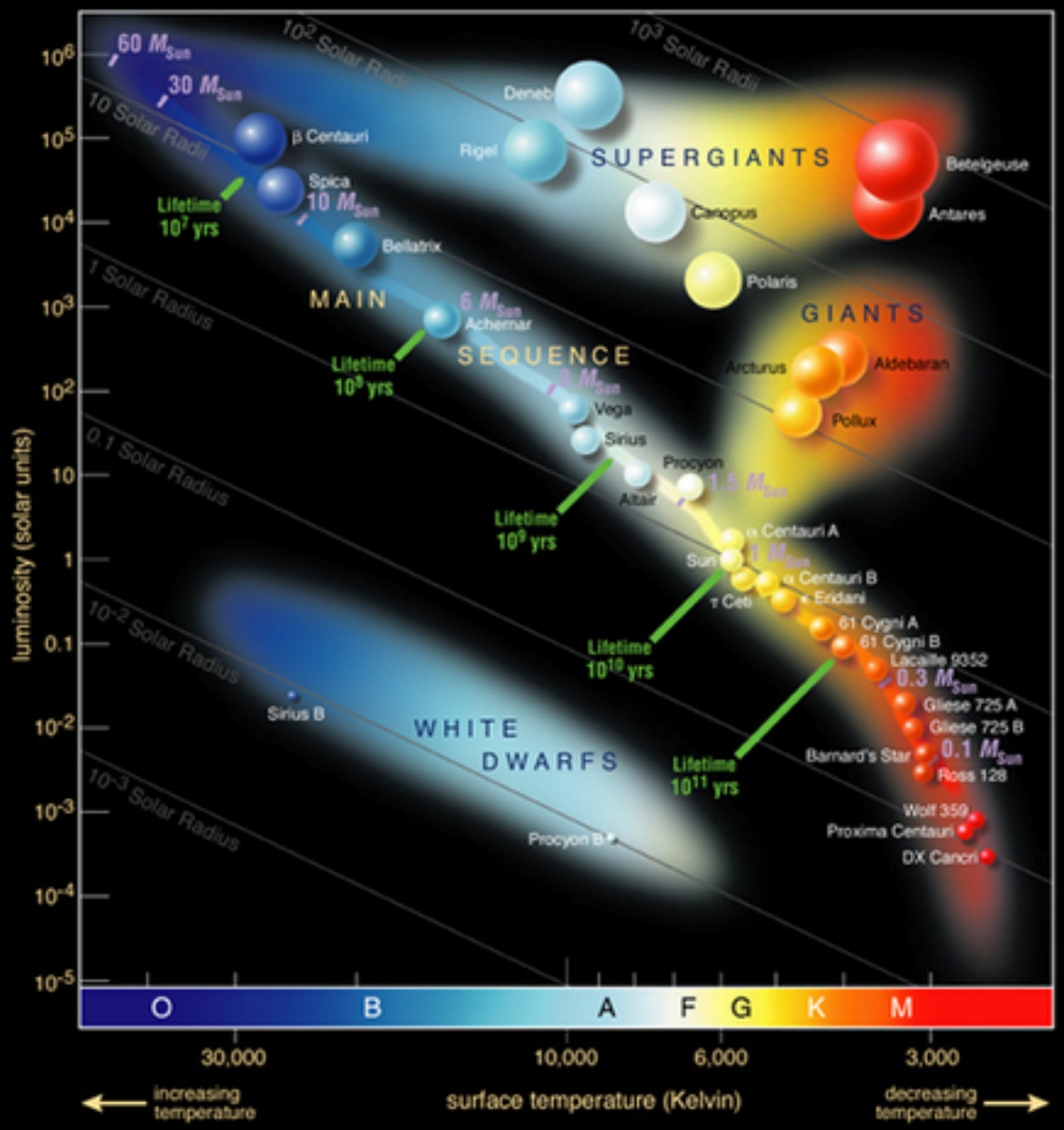
RUBRIC

ASTR101 Lab 3 Solar /15 + /6 + /12 + /15 + /21 + /15 + /6 + /10(neatness) − /100

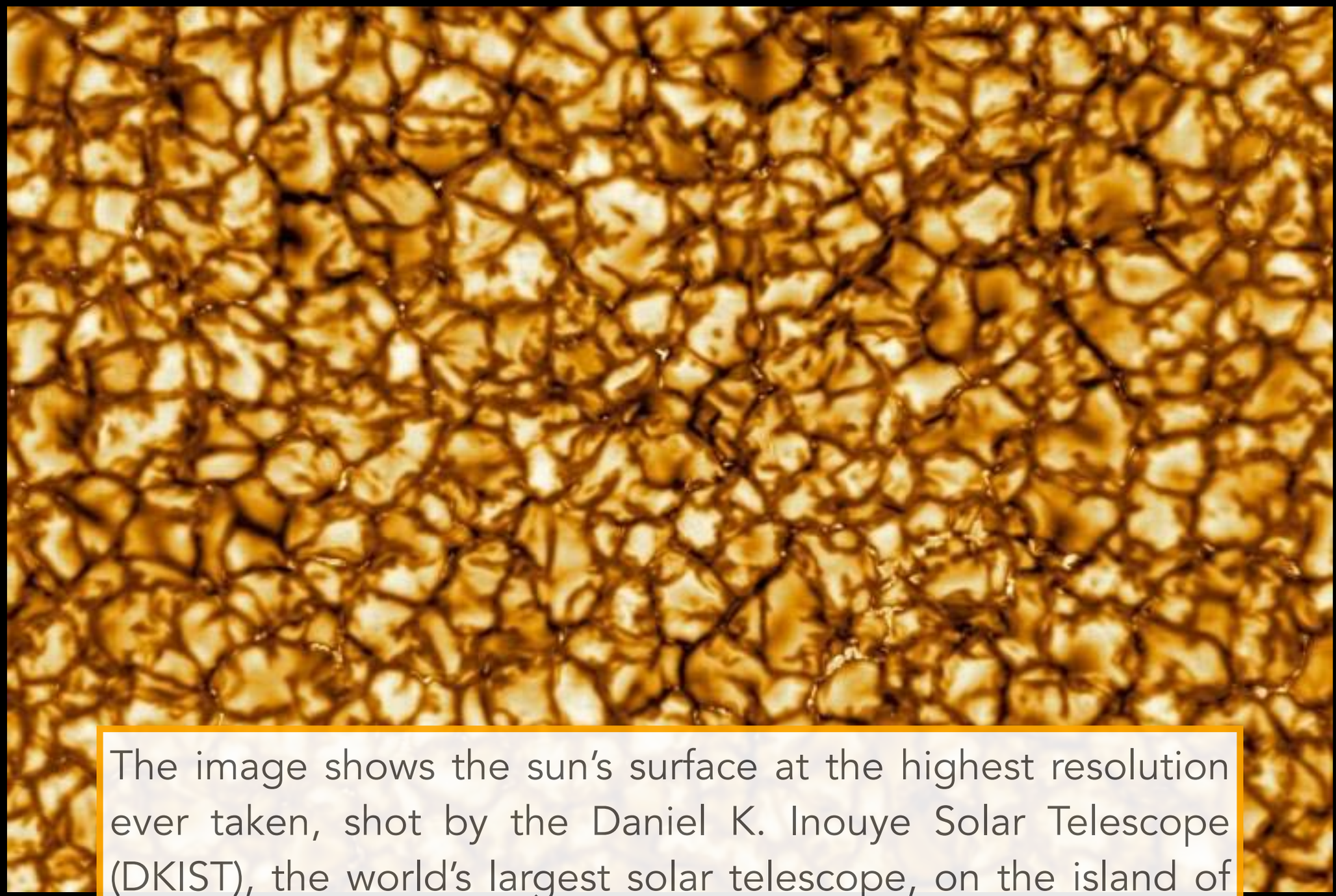
Grade Value	0	1	2	3	Weight
Objective & Introduction	Content missing	Basic content. Non-scientific jargon and wording. Diffienlt to understand sentences.	Acceptable content. Some attempt at scientific terminology. Sentences acceptable.	Excellent content. Proper use of jargon and scientific wording. Assumptions noted and justified.	5
Grade Value	0	1	2	3	Weight
Procedure	Content missing	Basic content. No special equipment described, minimal description of procedure, no discussion of measurement uncertainties.	Acceptable content. Special equipment noted, important points of procedure noted, basic discussion of measurement uncertainties.	Excellent content. Special equipment addressed and discussed, procedure detailed and informative, measurement uncertainties noted.	2
Grade Value	0	1	2	3	Weight
Observations, Tables & Graphs	Content missing	Basic content. Incomplete information. Tables missing title, or other details. Graphs missing titles, labels, and/or too small. Sketches lacking detail.	Acceptable content. Minor details missing from graphs, tables and sketches, but all major details present.	Excellent content. Tables and graphs complete. Observations thorough.	4
Grade Value	0	1	2	3	Weight
Calculations	Content missing.	Basic content. Many calculations missing. Units and significant figures ignored. No detailed calculations at the end of the report.	Acceptable content. Most calculations present, but some details missing. Units and significant figures use inconsistent.	Excellent content. All calculations included. Units and significant figures present in all calculations.	5
Grade Value	0	1	2	3	Weight
Answers	Content missing.	Basic content. Questions answered simplistically; answers show lack of insight. Results not clearly discussed. Units neglected. No link between objective and results.	Acceptable content. Questions mostly answered correctly. Results mentioned, with spotty units. Weak link provided between objective and results.	Excellent content. Questions answered in detail. Clear connection between objective and results. Units clearly included.	7
Grade Value	0	1	2	3	Weight
Discussion	Content missing.	Basic content. Lacking discussion about expectations, assumptions, and consistency. No discussion about broader context.	Acceptable content. Limited discussion of expectations, assumptions and consistency. Limited discussion of broader context.	Excellent content. Expectations, assumptions and consistency clearly and correctly addressed. Broader context discussed.	5
Grade Value	0	1	2	3	Weight
Conclusion & References	Content missing.	Basic content. Conclusion unclear or lacking insight. References limited or missing.	Acceptable content. Correct conclusion but limited. Some references included.	Excellent content. Conclusion correct and focused. Detailed references included.	2

SUN FACTS

- The sun is a G-Type star.
- Surface temperature of roughly 5,778 degrees Kelvin.
- About 1.4 million km in diameter.
- Can fit over 1 million Earths.



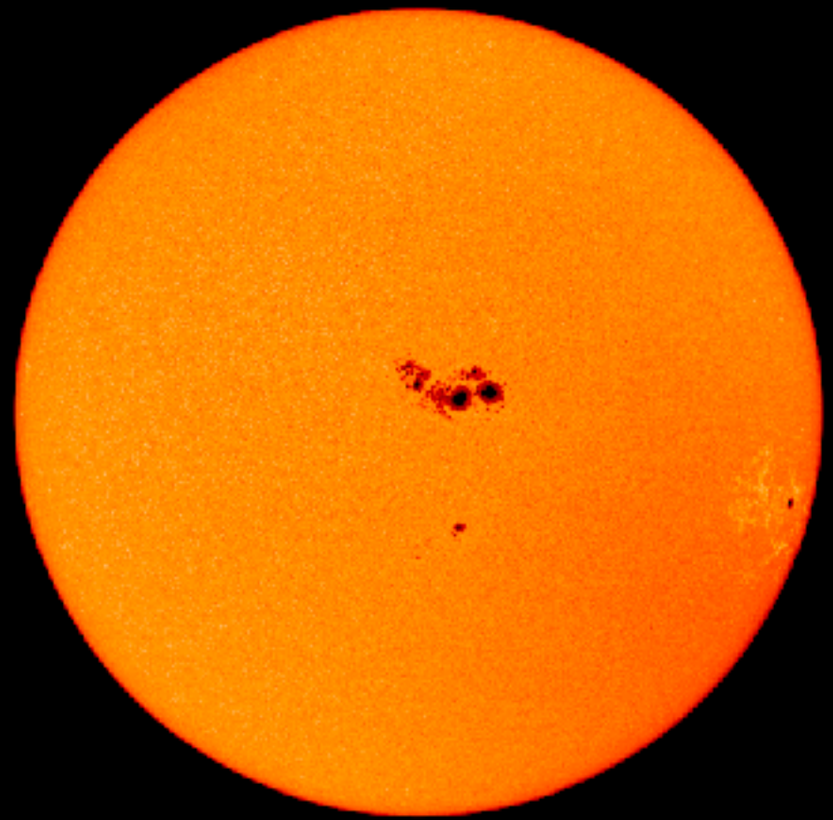
THE SUN IS NOT A SOLID BODY



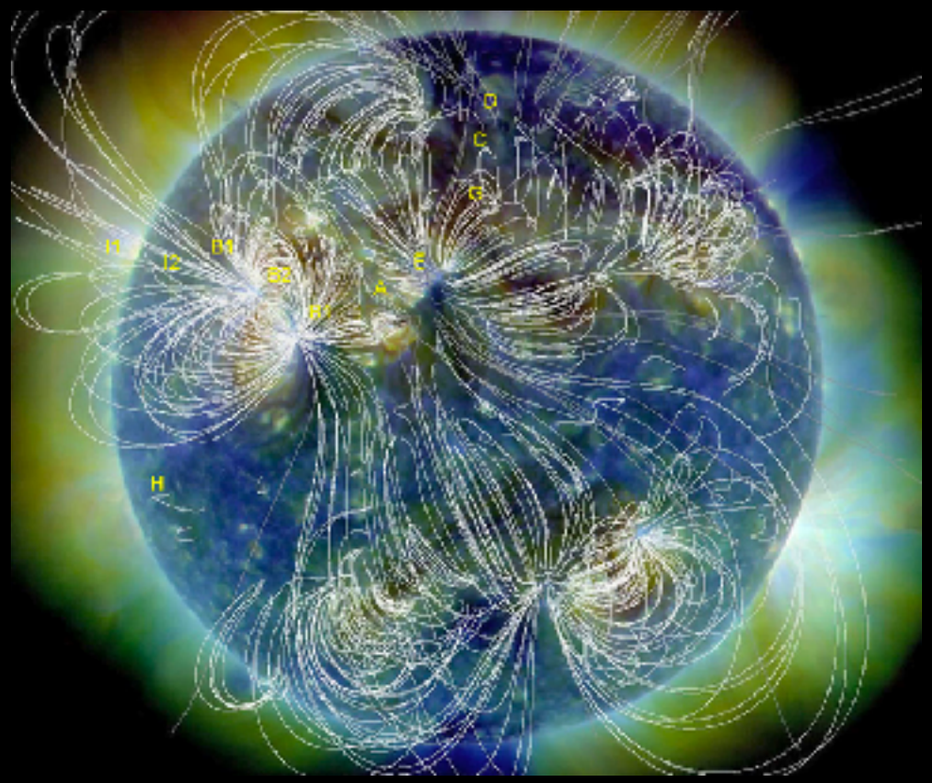
The image shows the sun's surface at the highest resolution ever taken, shot by the Daniel K. Inouye Solar Telescope (DKIST), the world's largest solar telescope, on the island of Maui, Hawaii, U.S., January 29, 2020.

SUN SPOTS

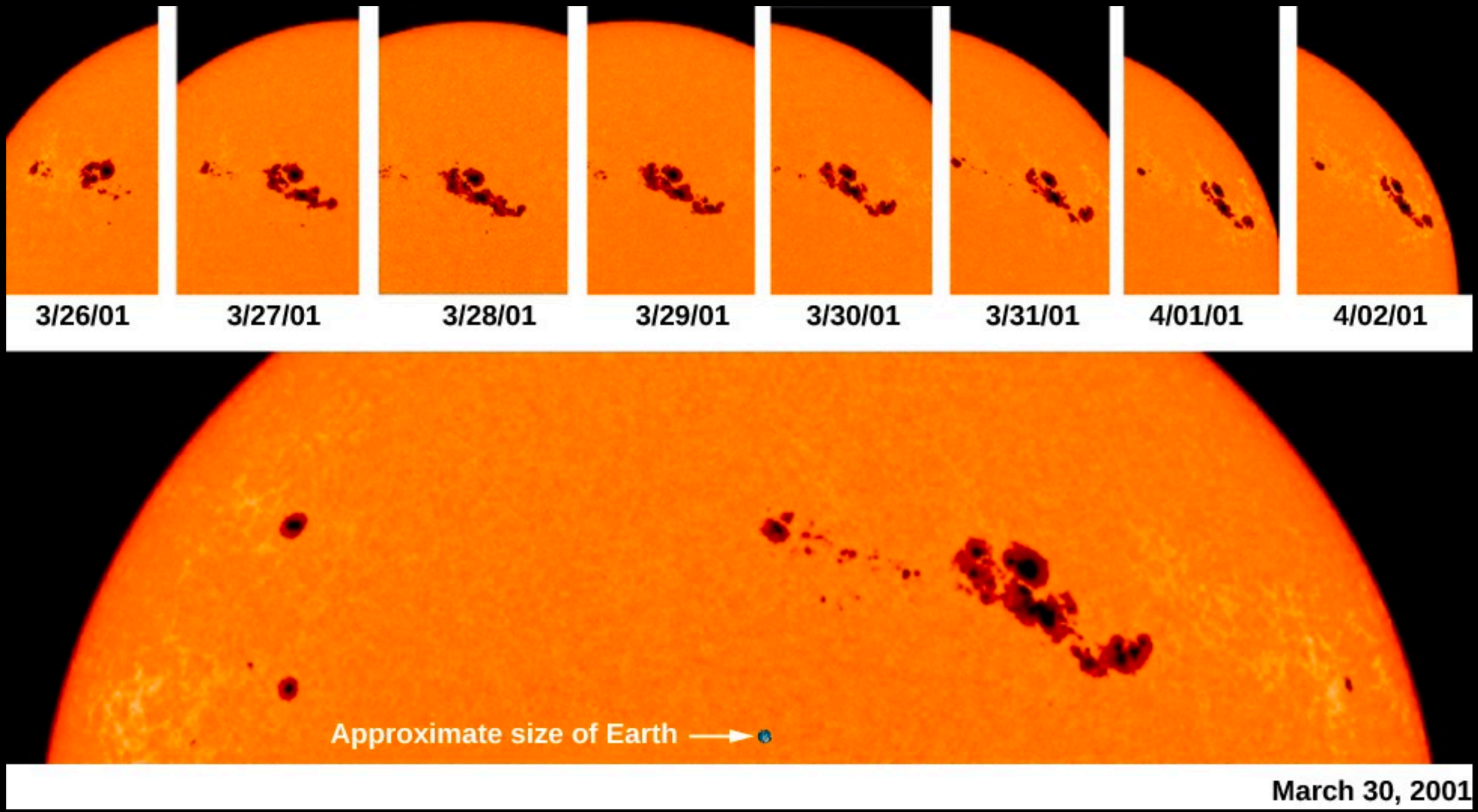
- Internal convection causes strong magnetic fields.
- Concentration of magnetic field flux causes sun spots.



- Sun spots are found on the photosphere.
- Are at a lower temperature compared to the rest of the surface.
- Shows that the “heavens” are not perfect, contrary to old Ptolemaic/Greek cosmology as taught by the church.

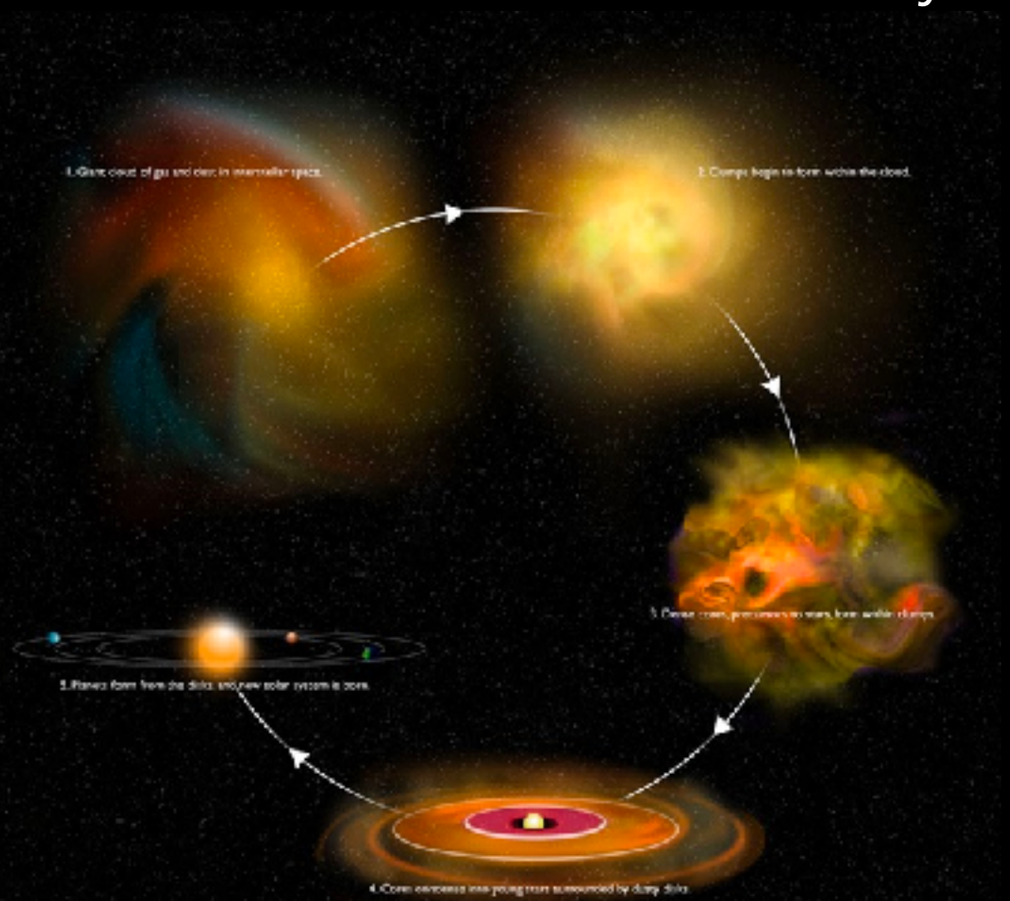


We can use sun spots to measure the rotational period of the sun

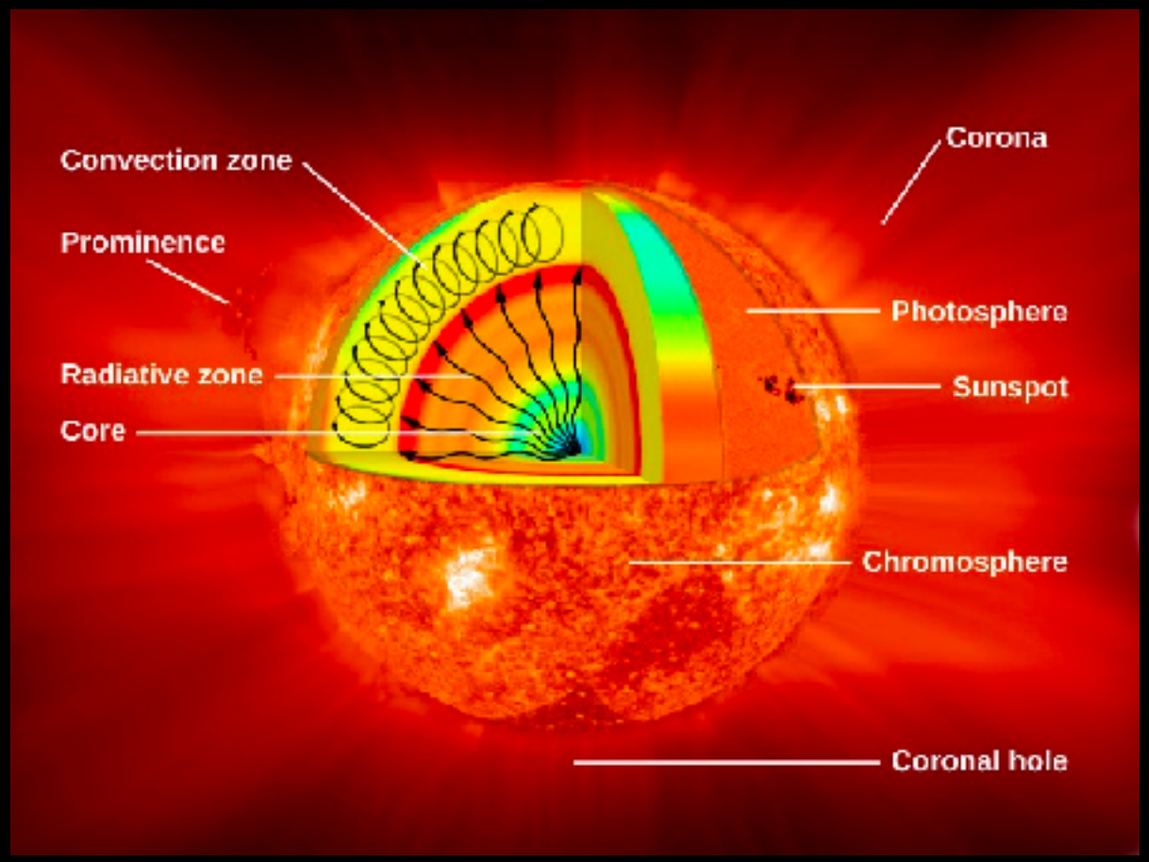


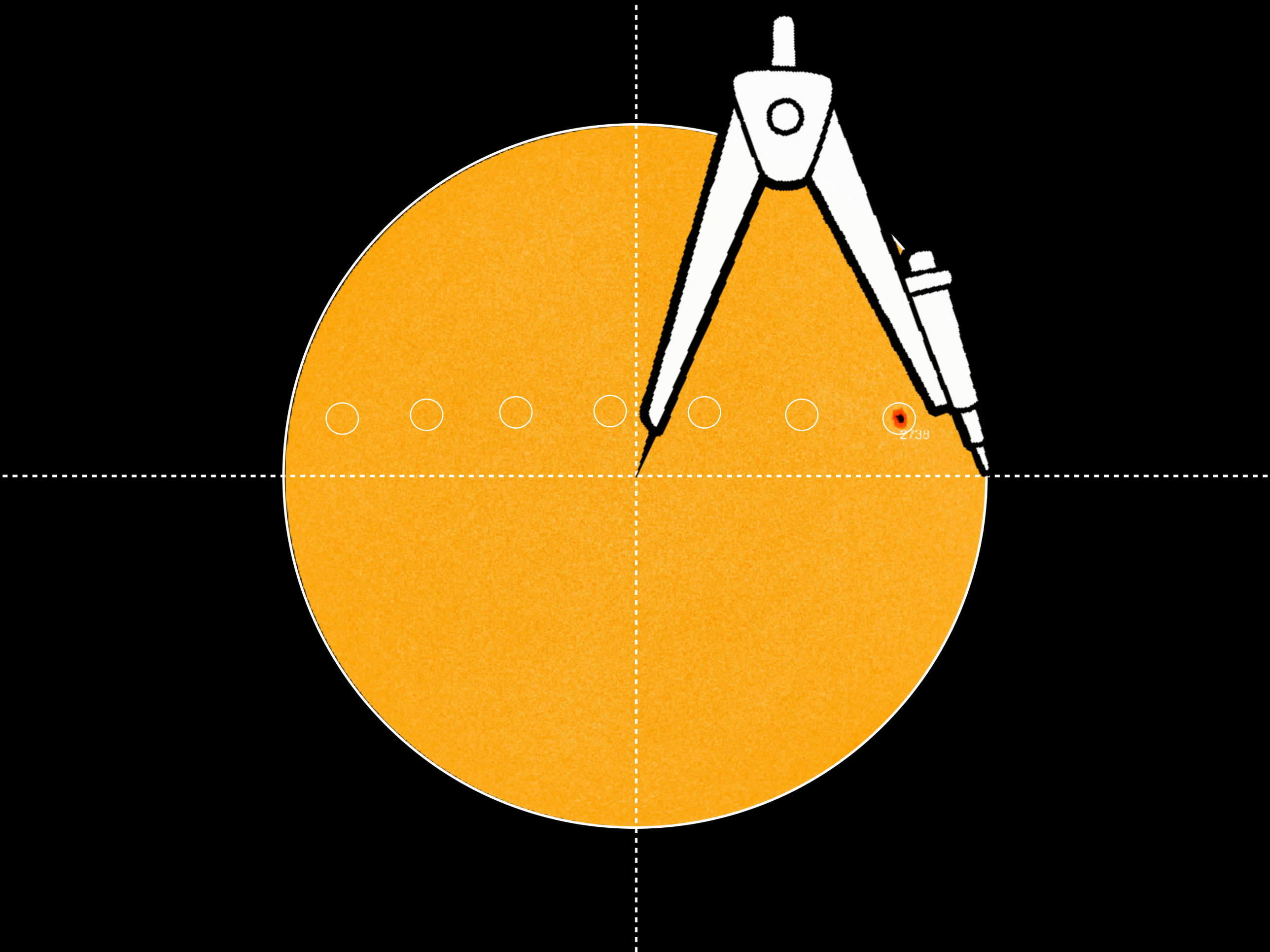
WHAT CAN THE SOLAR ROTATION TELL US?

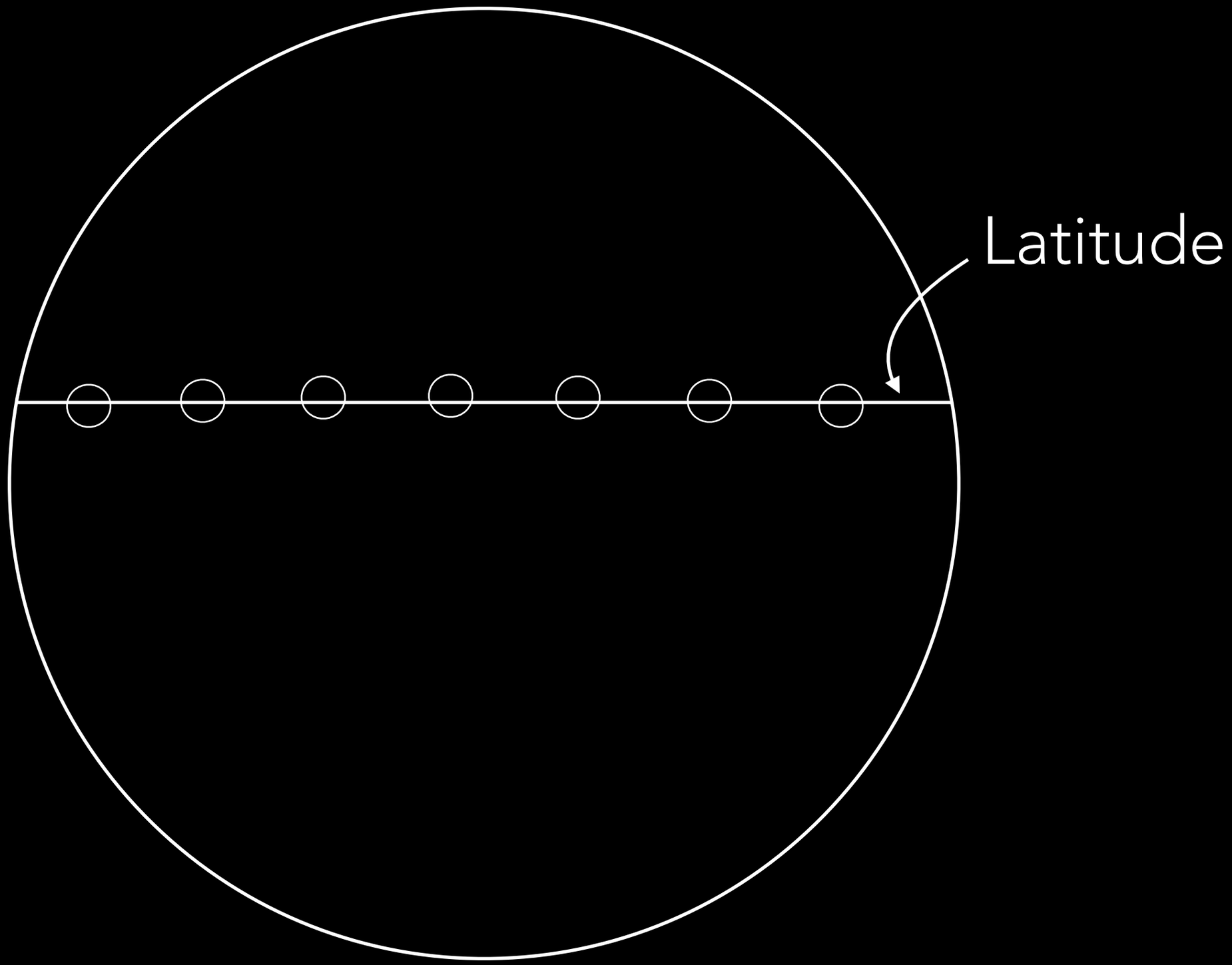
The Sun’s formation history



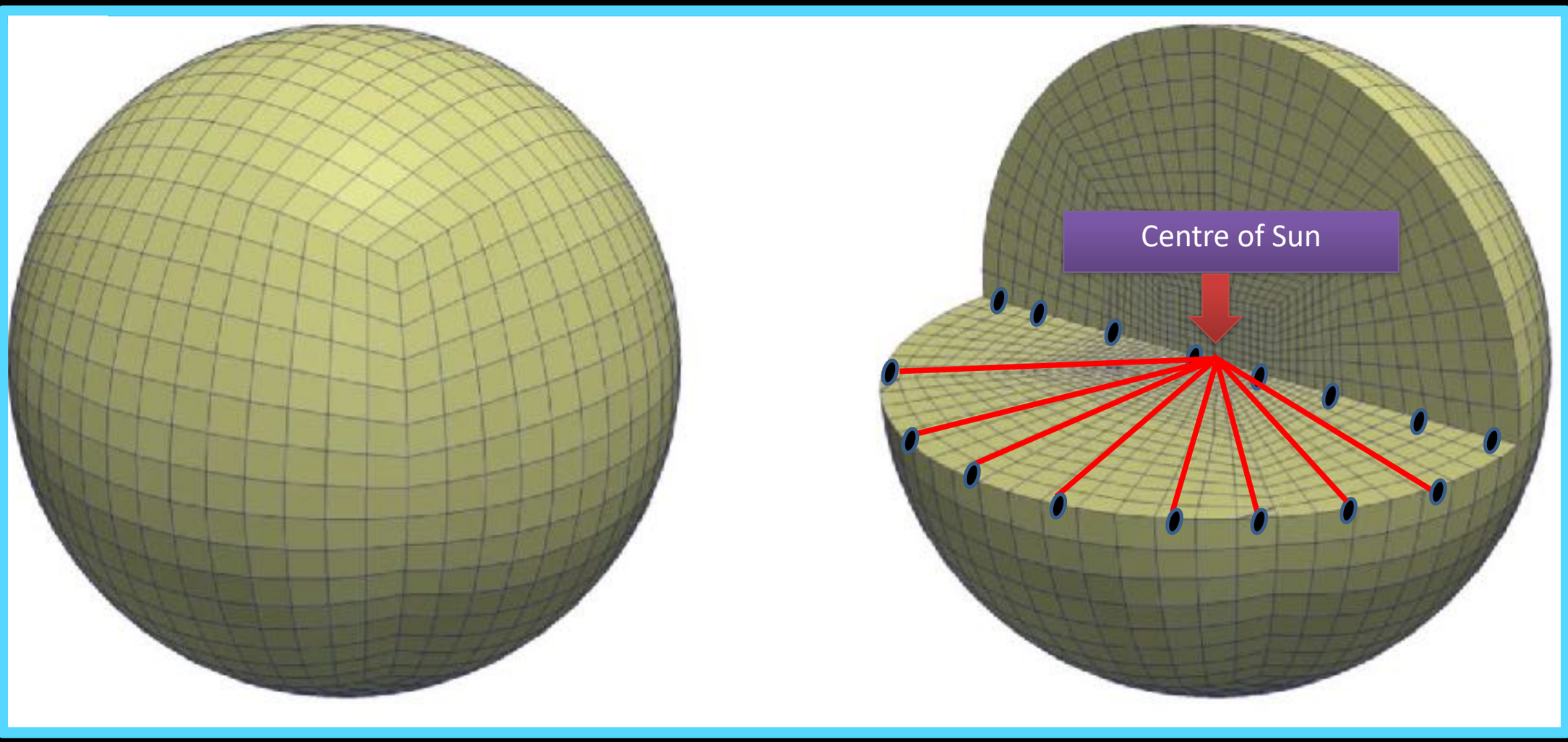
The Sun’s internal dynamics

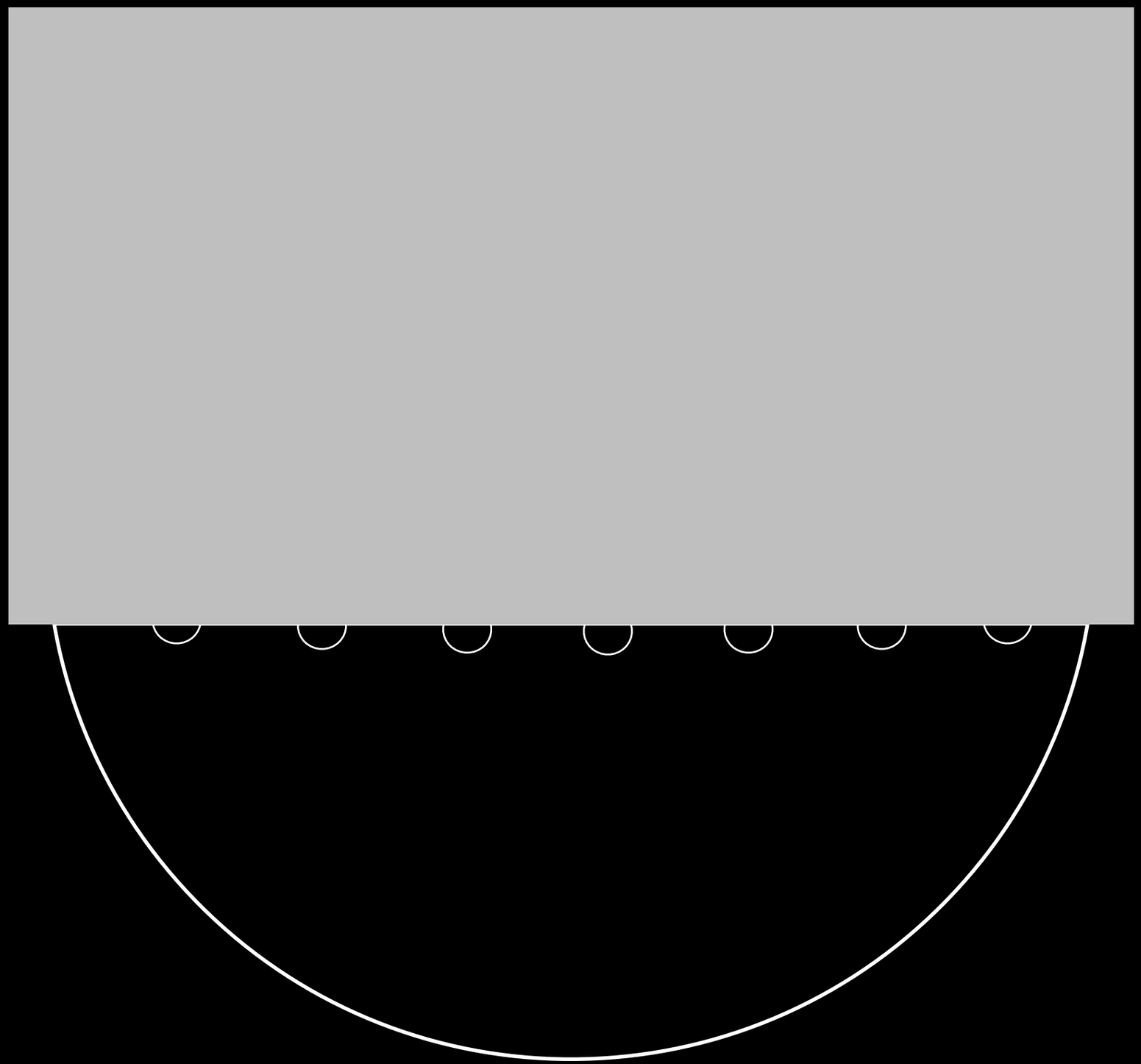





Latitude

PROJECTION: SUN IS NOT 2D

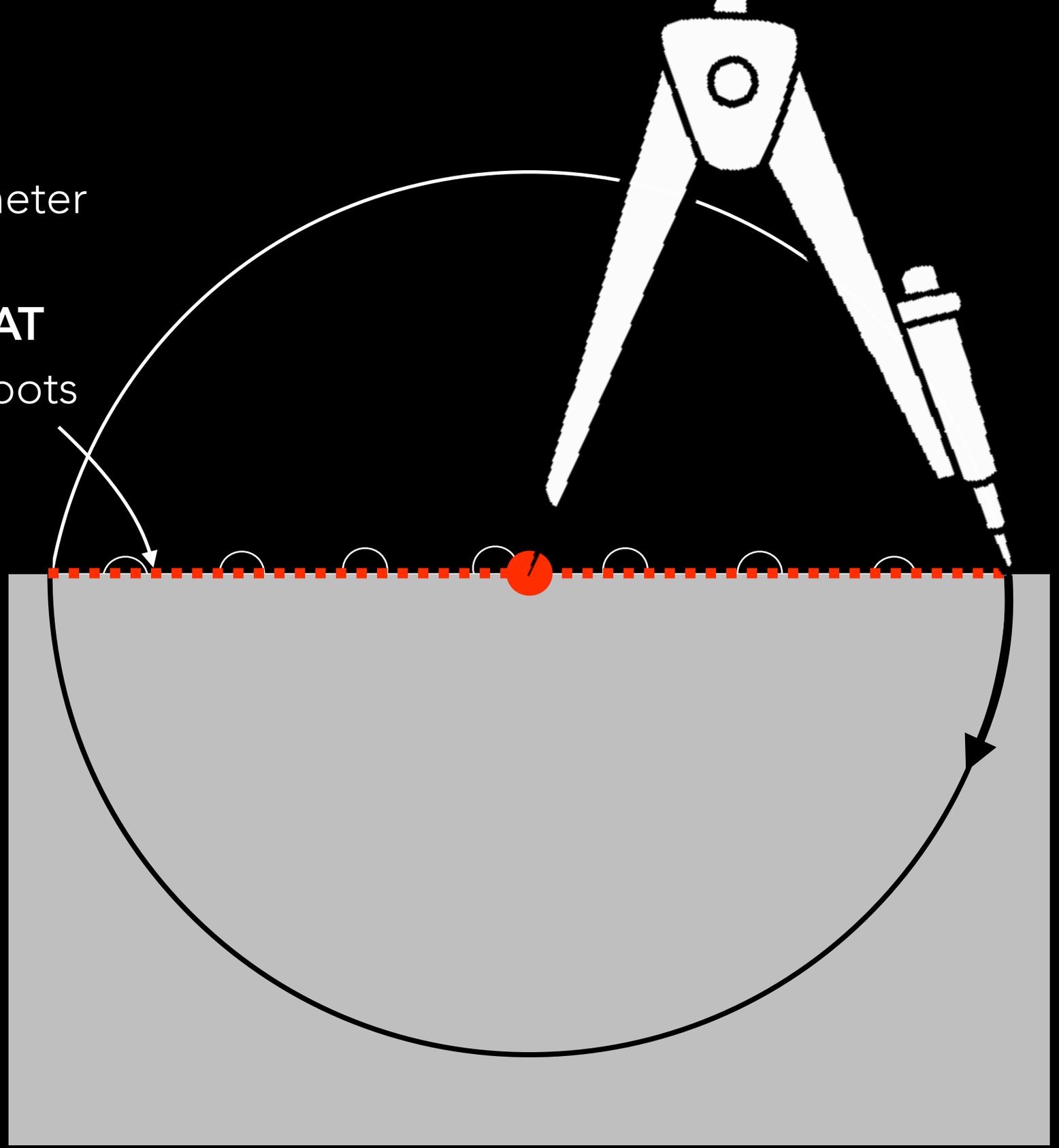


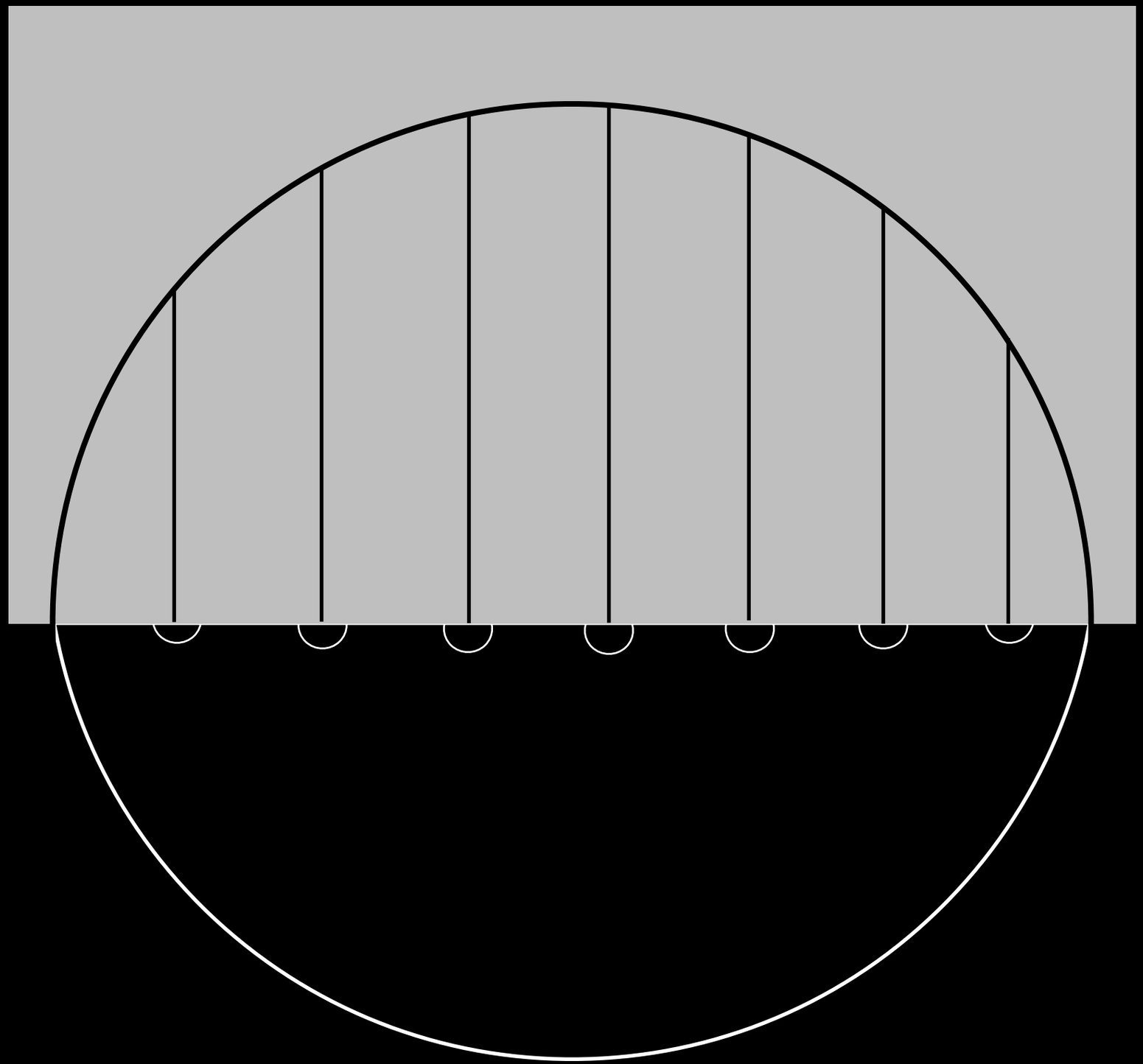


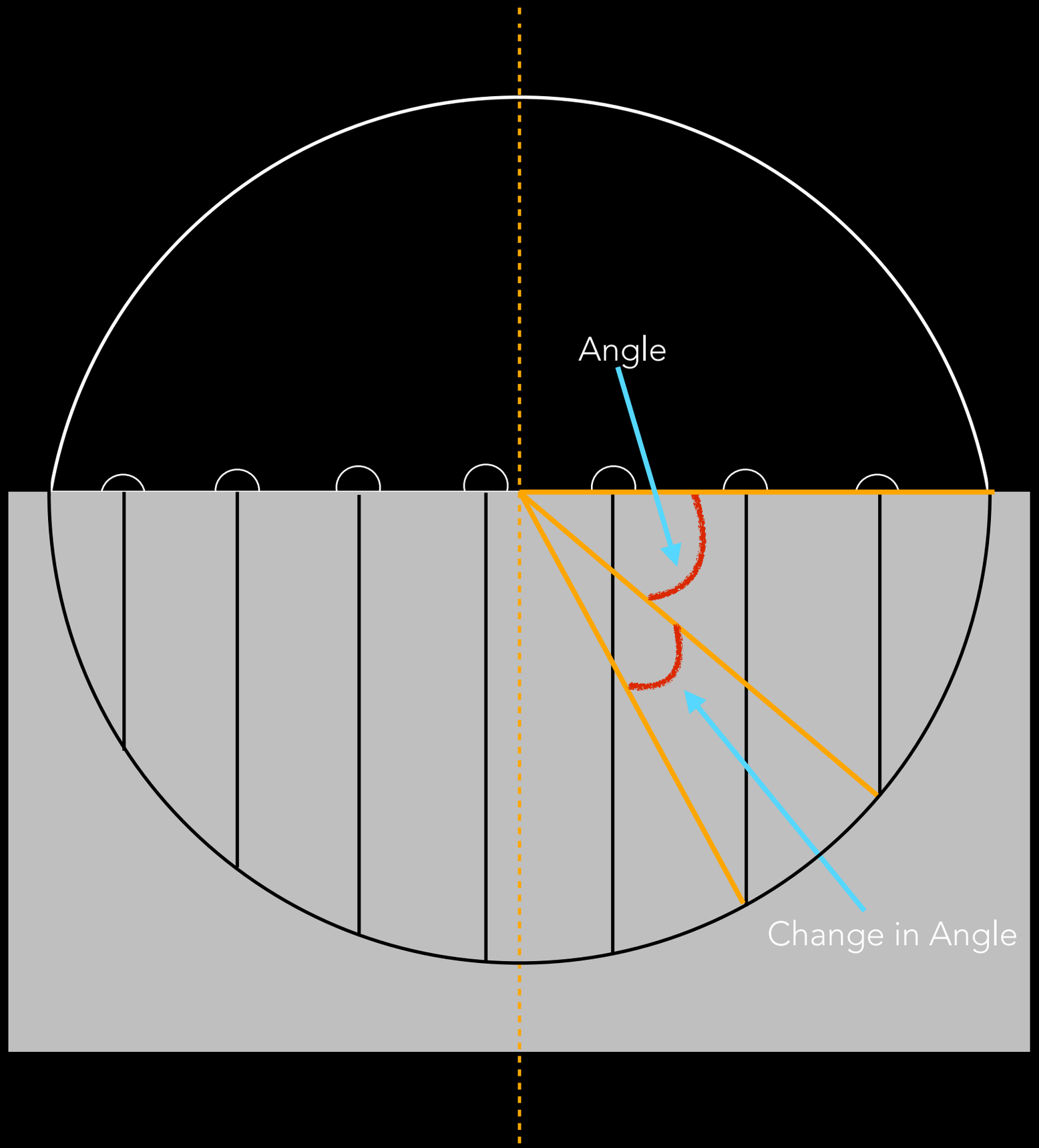
Semi-circle diameter

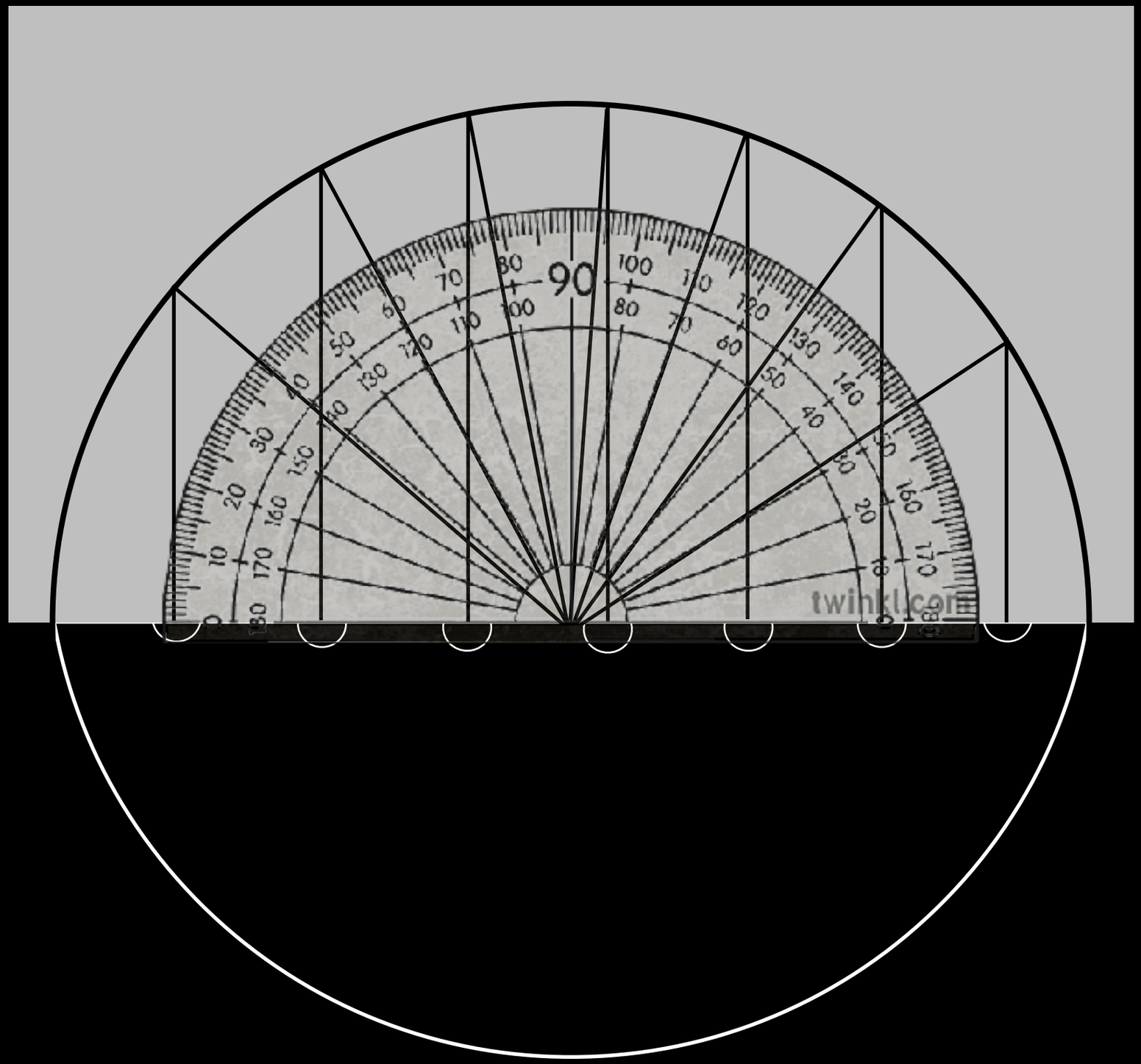
=

Width of Sun **AT** latitude of sunspots






Angle
Change in Angle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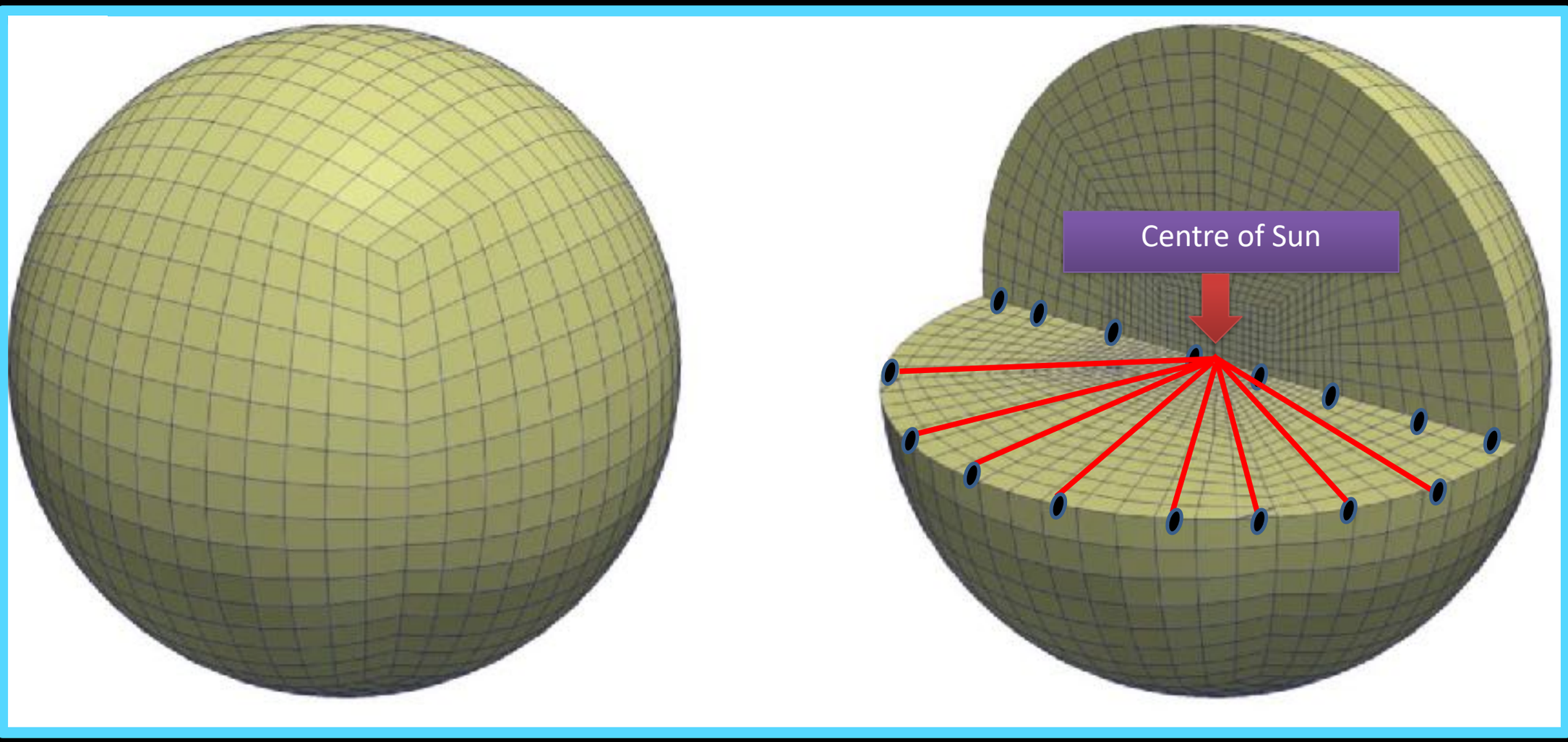
PROJECTION: SUN IS NOT 2D



ASSUMPTIONS

- The sun is perfectly spherical.
- Sun spots don’t change shape with time.
- Sun spots will move at the same rate towards the edges of the sun as they do towards the middle (look up foreshortening).
- How you decide to measure each sun spot.

INSTRUCTIONS CONT.

- Calculate the rotational period: P = (360deg / ΔAngle) x 1 day

- Calculate the mean and uncertainty for the period: Order your measured periods from lowest to highest. Middle value will be your mean. Take 2nd to lowest period and subtract from 2nd to highest and divide by 2. This is your uncertainty. Or you can calculate mean and standard deviation which = $\sqrt{\Sigma(P_i - \overline{P})/N}$.

- Answer questions 1-5:

  -Q1: Measure sunspot closest to the middle.

  -Q5: Sidereal period = (360deg / (ΔAngle + 1deg)) x 1 day