

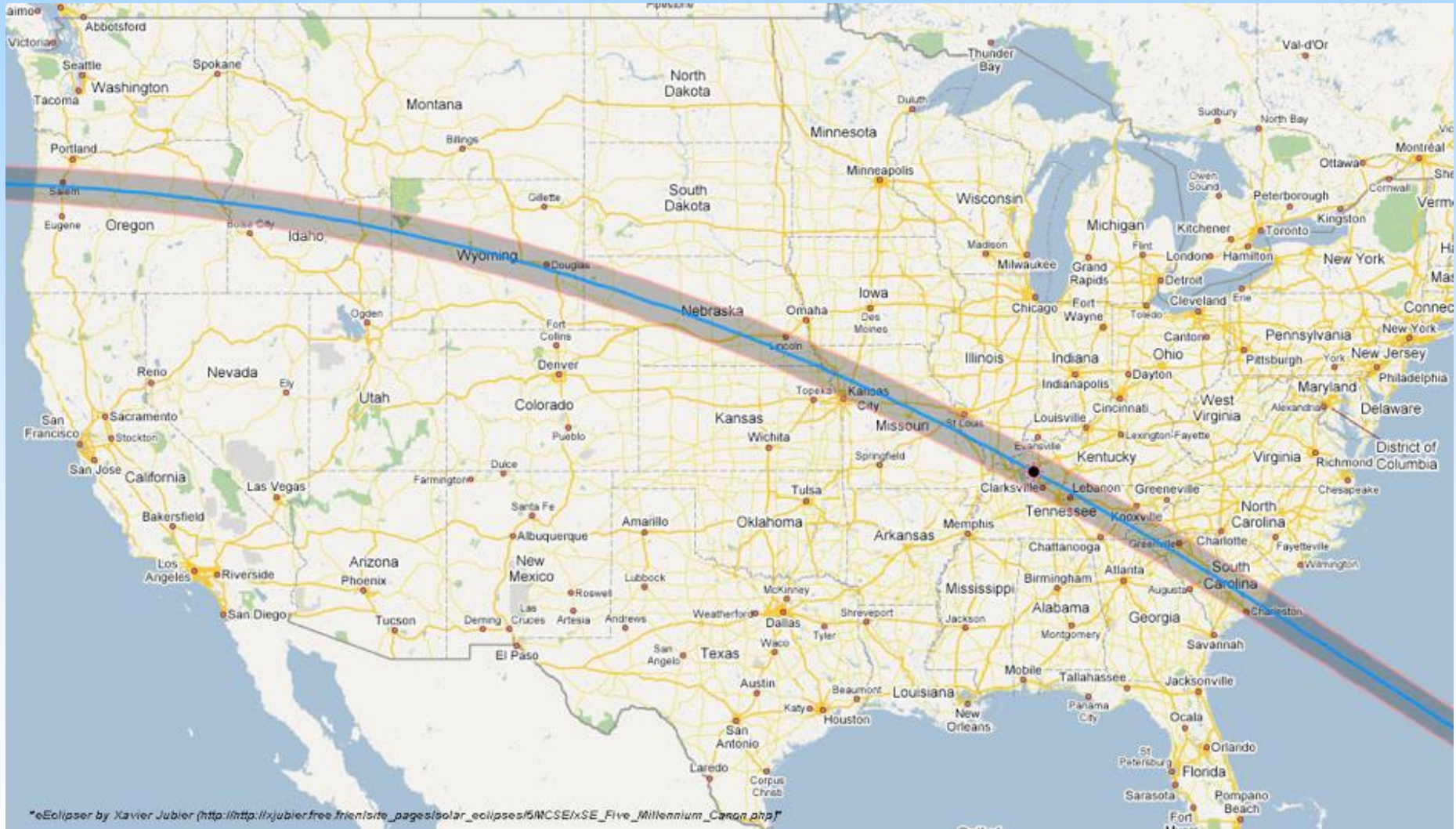
# Solar Eclipses: Front Line Experiences, and Some Science

Dr. Alphonse Sterling  
NASA/MSFC

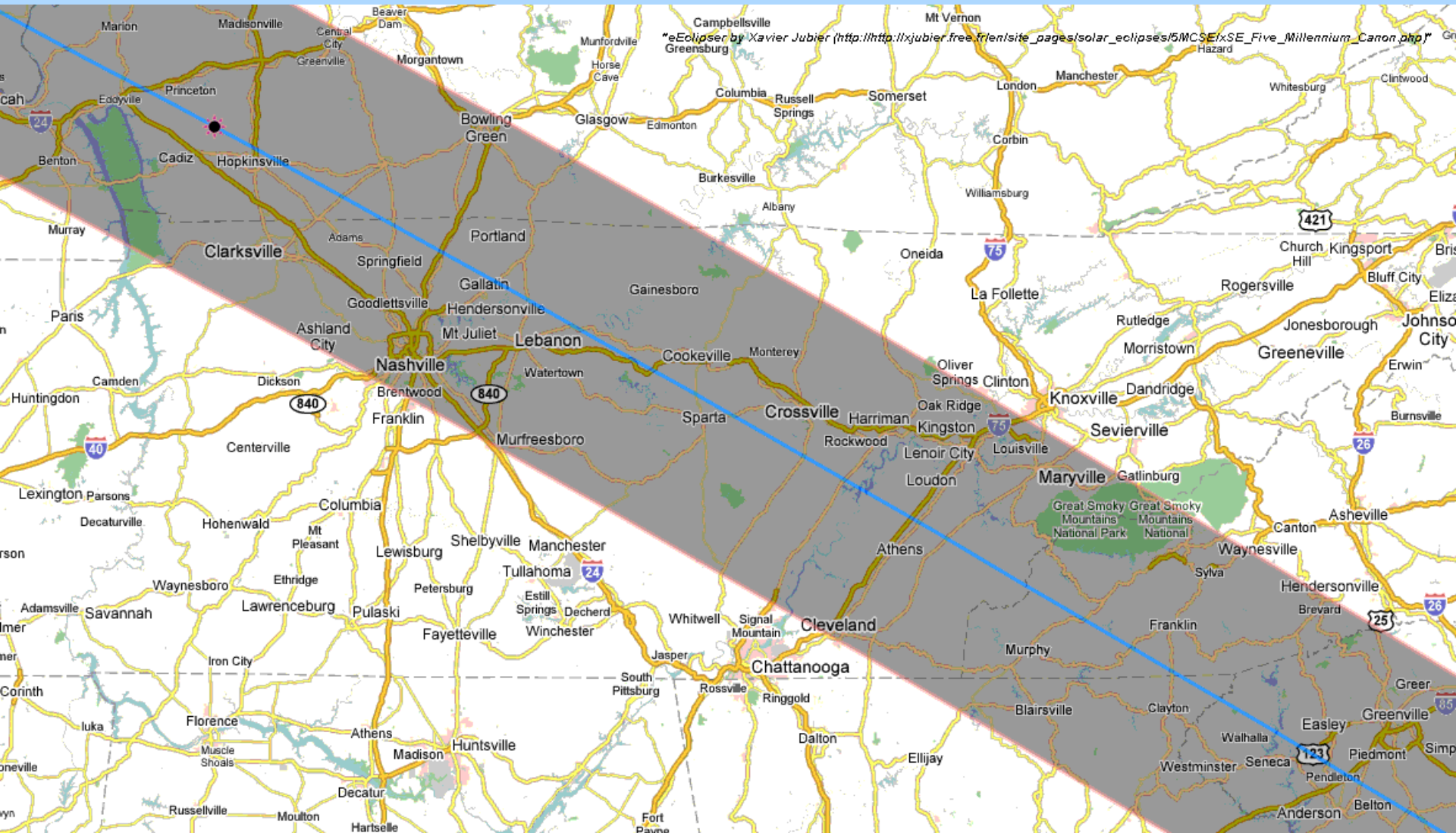
# Today's Discussion:

- A brief review of the 21 August 2017 eclipse.
- A couple of experiences from the “front line” of past eclipses.
- The motivation for doing solar eclipse studies (just an outline...).

# August 21, 2017 Total Solar Eclipse Path



# August 21, 2017 Total Solar Eclipse Path



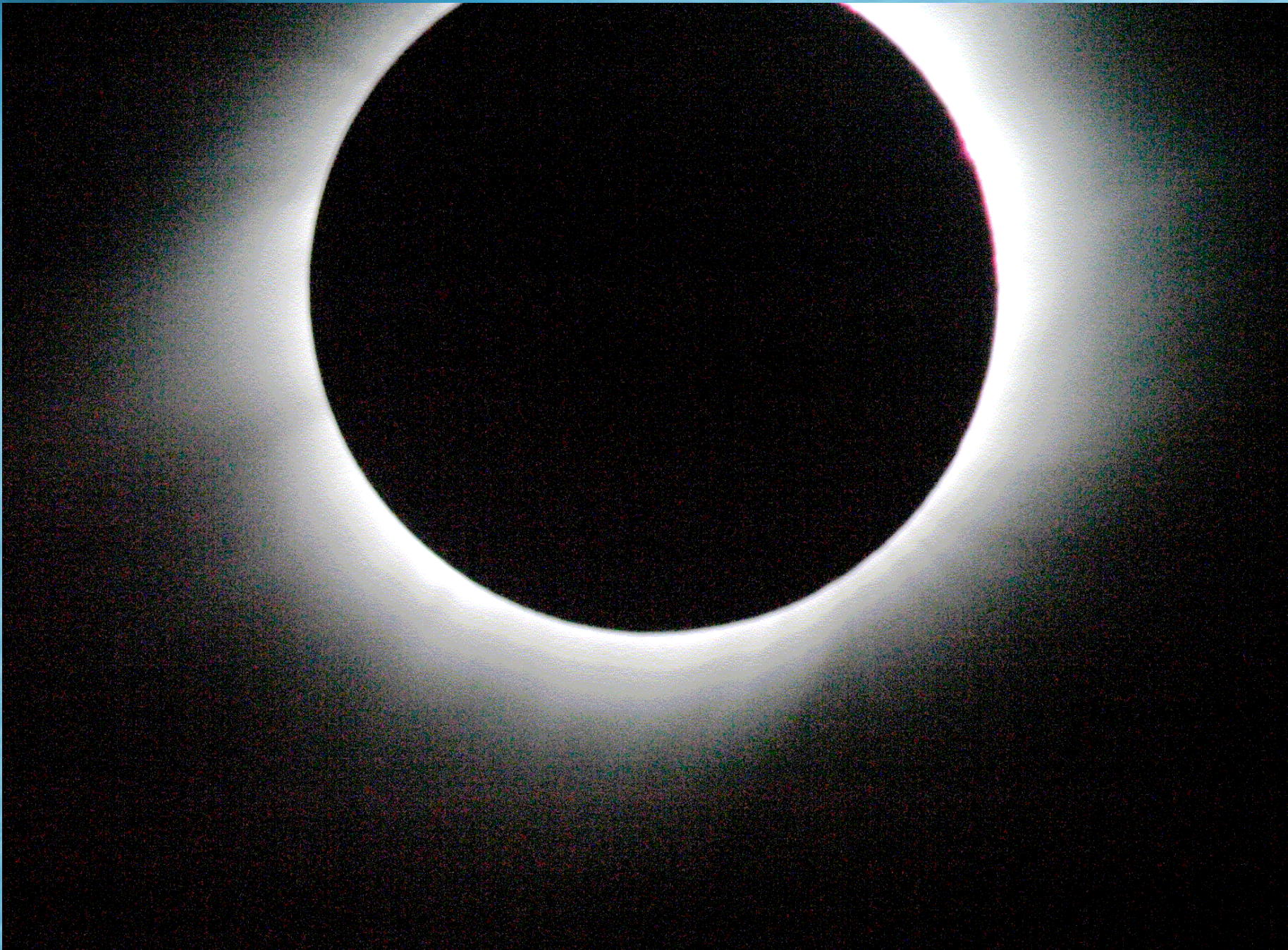
# Do not Risk Your Precious Eyes!!

- Do *not* look at the partial phases of the eclipse directly without certified eye protection!!
- There's no point to staring at partial phases....
- Look without protection only if you're in the totality path, and then only during totality! (About 2 minutes.)

# How *Not* to do Eclipse Science! Ghana 2006 Version

(Useful information for picture takers too.)







# Lessons Learned (Science at Eclipses)

- 🕒 No new equipment.
- 🕒 Settle on a location, and stick to it if at all possible.
- 🕒 Practice, practice, practice!



Gansu Province, China, 2008













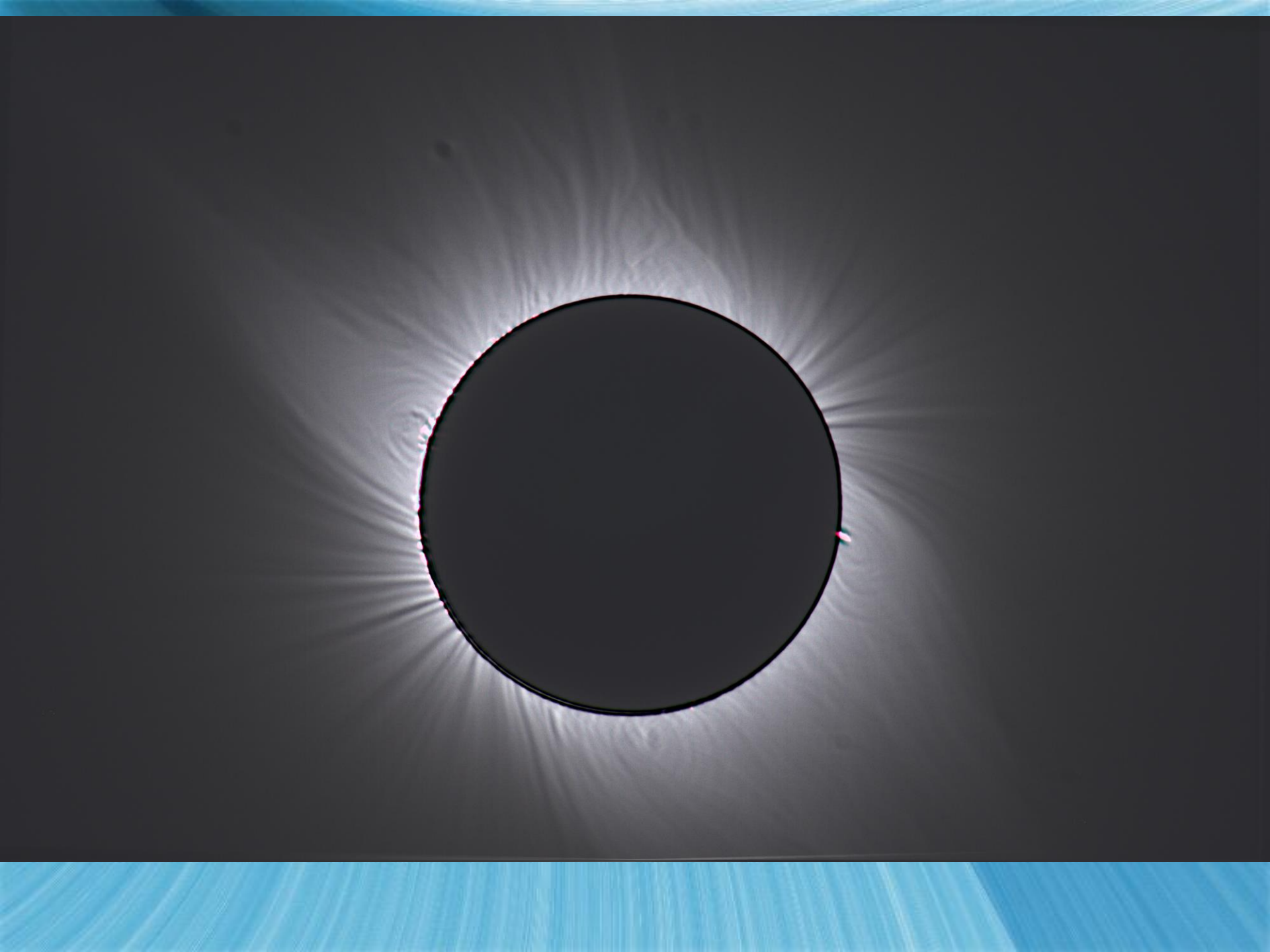








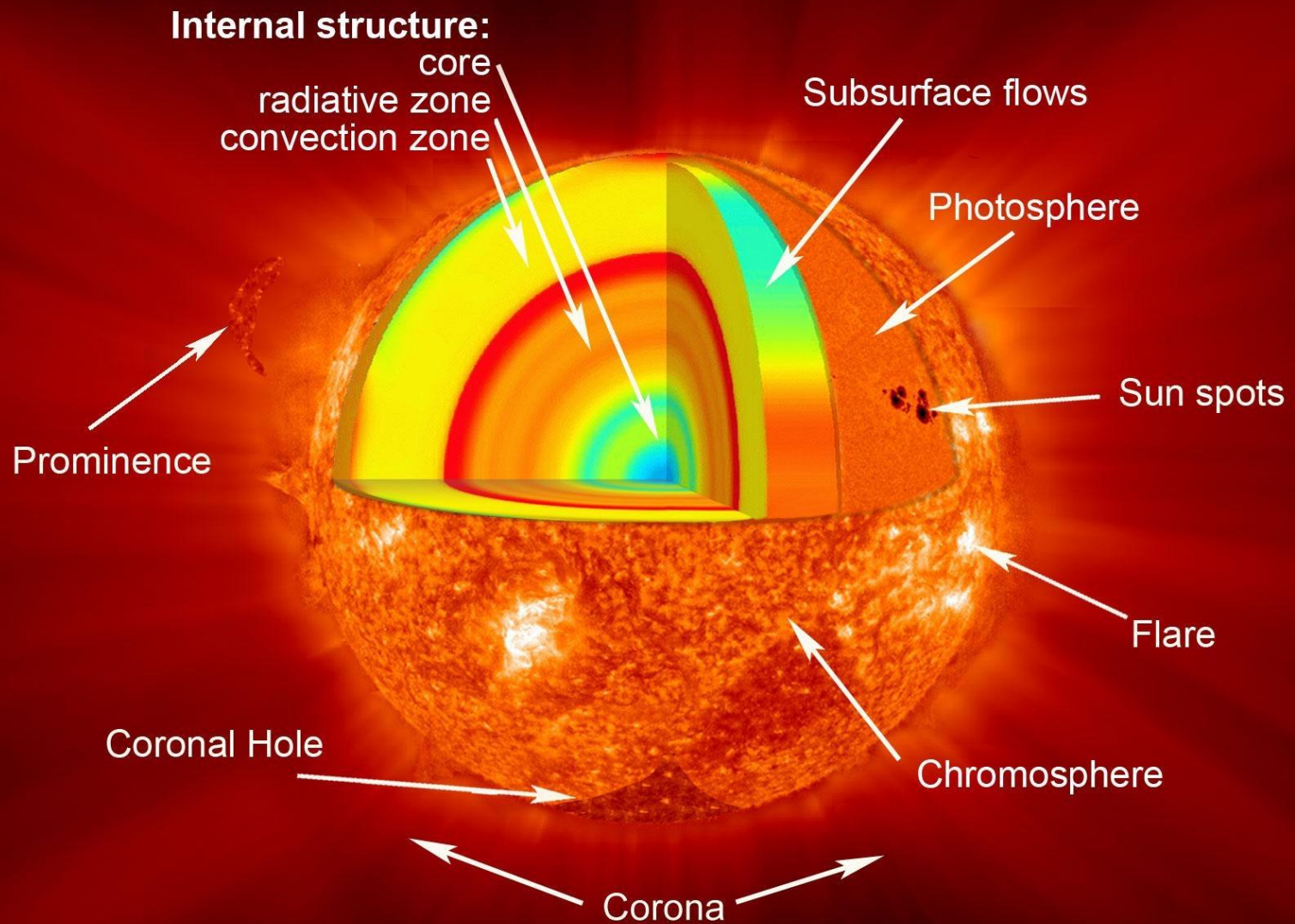


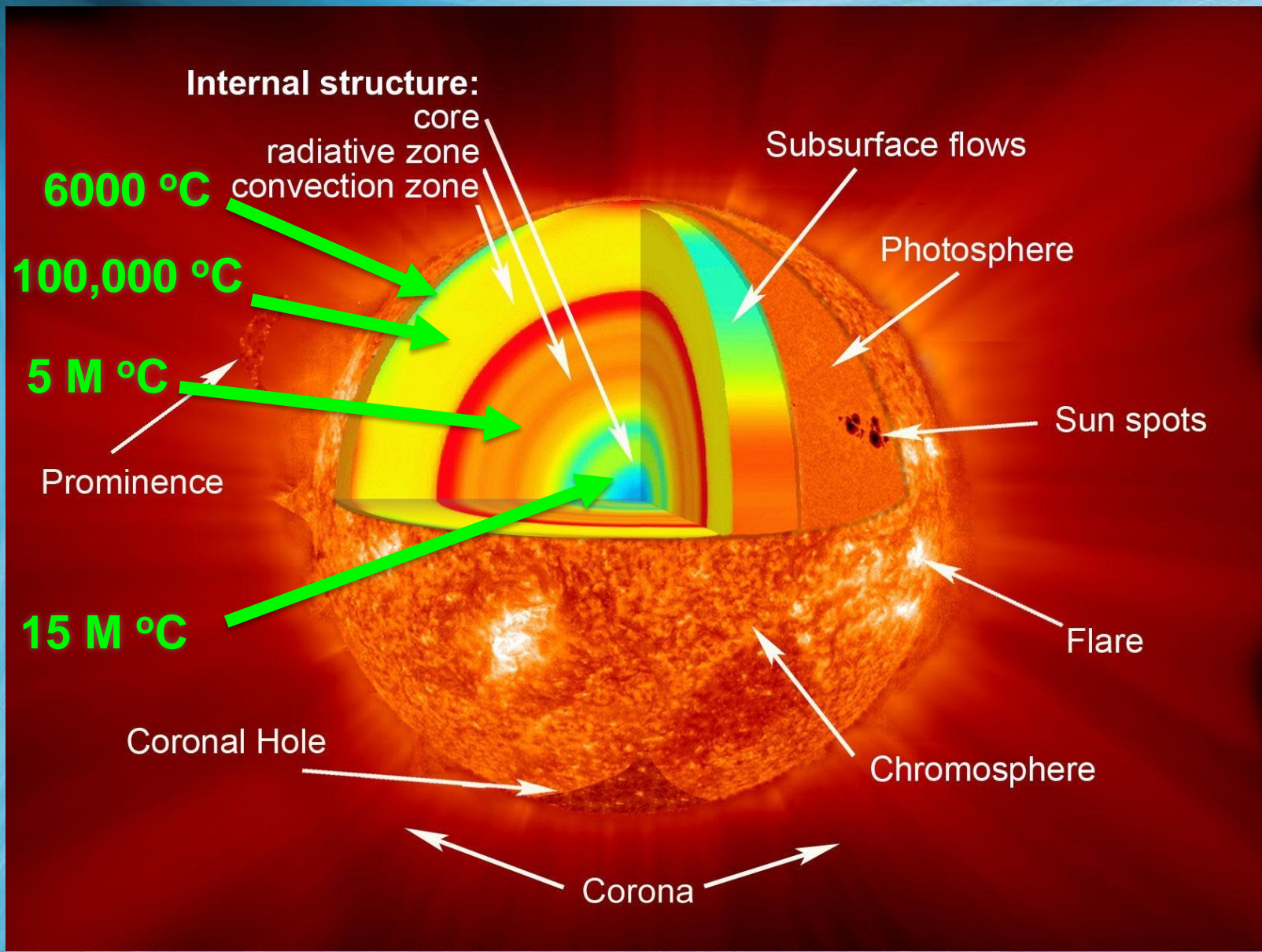




# Science of the Sun. A key Problem: The Temperature of the Corona



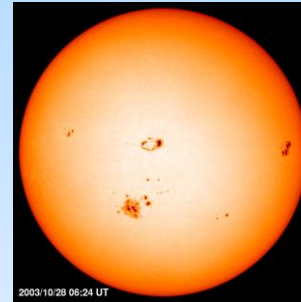




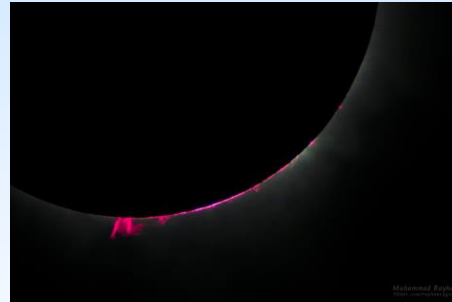
# The Solar Atmosphere

The Outer layers (Atmospheres) of the Sun:

- Photosphere



- Chromosphere



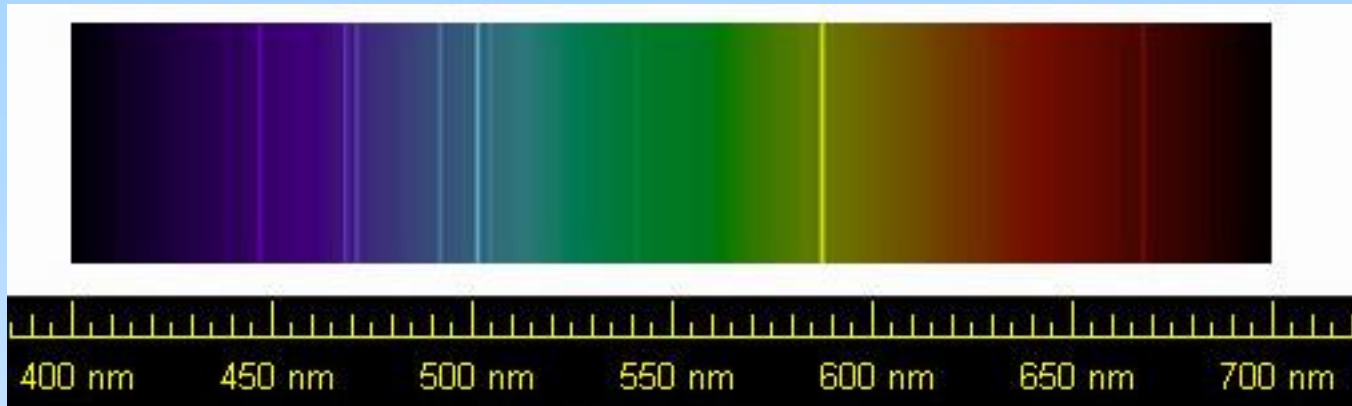
- Corona



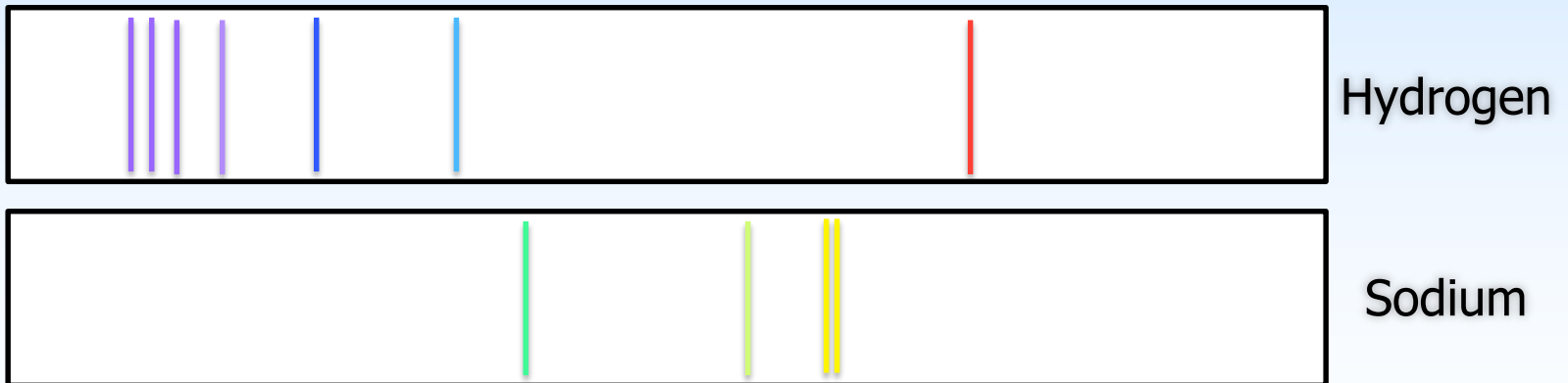
# But....

- A “problem” resulted from 1869 eclipse observations of the corona.
- Used a recently developed instrument - the “spectroscope,” to study the corona.

# Spectra



- Breaks light into “rainbow” colors, with lines.
- Different elements produce different lines.
- So these lines are like “fingerprints” for elements.



- Hence, spectra can be used to determine the composition of far-away objects, like the corona.

# But...

- A “problem” resulted from 1869 eclipse observations of the corona.
- Used a recently developed instrument - the “spectroscope,” to study the corona.
- Found lines that could not be identified!

# But...

- A “problem” resulted from 1869 eclipse observations of the corona.
- Used a recently developed instrument - the “spectroscope,” to study the corona.
- Found lines that could not be identified!
- Many explanations considered, including a “new” element: *coronium*.

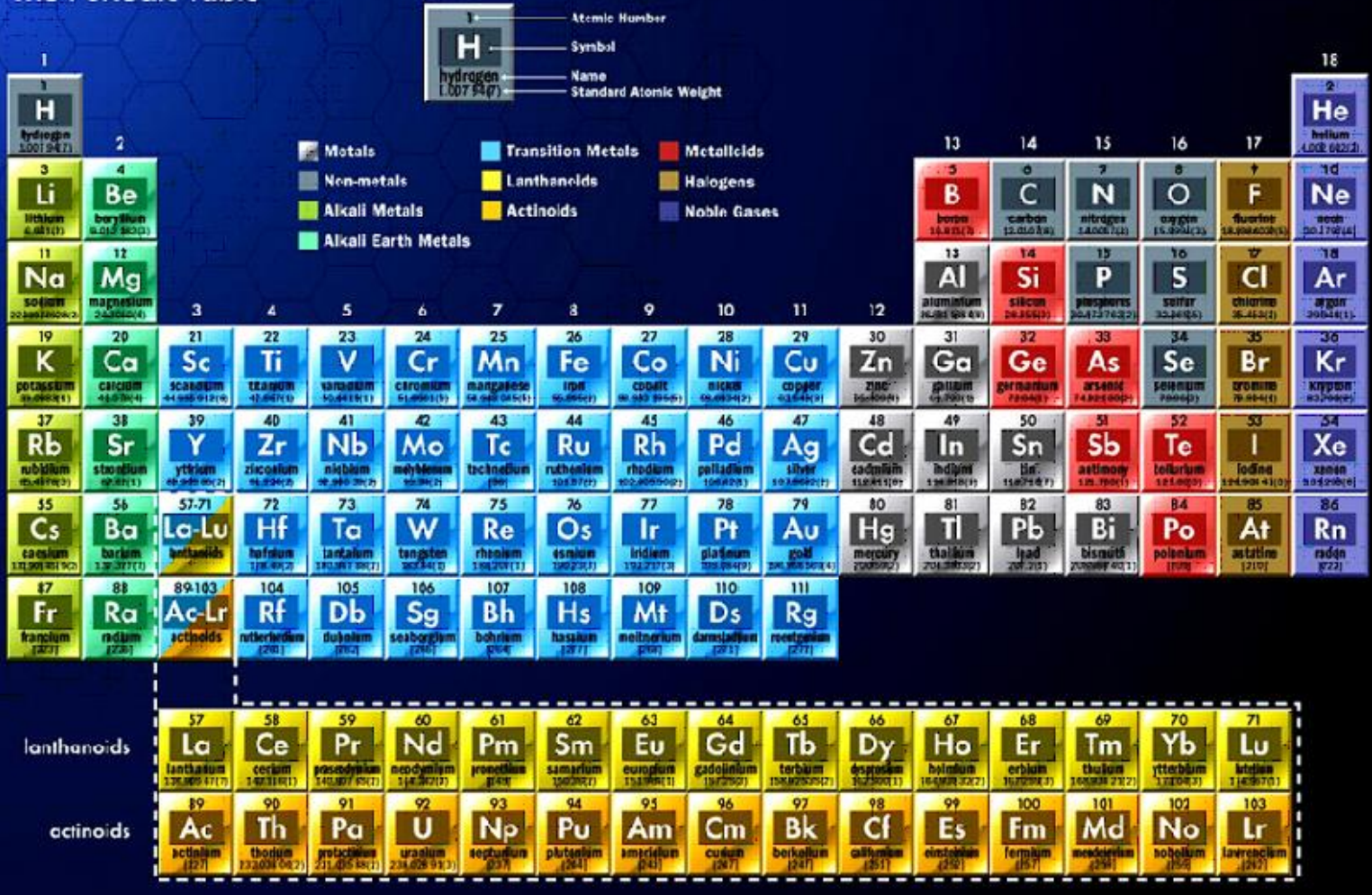
# But...

- A “problem” resulted from 1869 eclipse observations of the corona.
- Used a recently developed instrument - the “spectroscope,” to study the corona.
- Found lines that could not be identified!
- Many explanations considered, including a “new” element: *coronium*.

But this didn't work....



# The Periodic Table



NASA/CXC/SAO



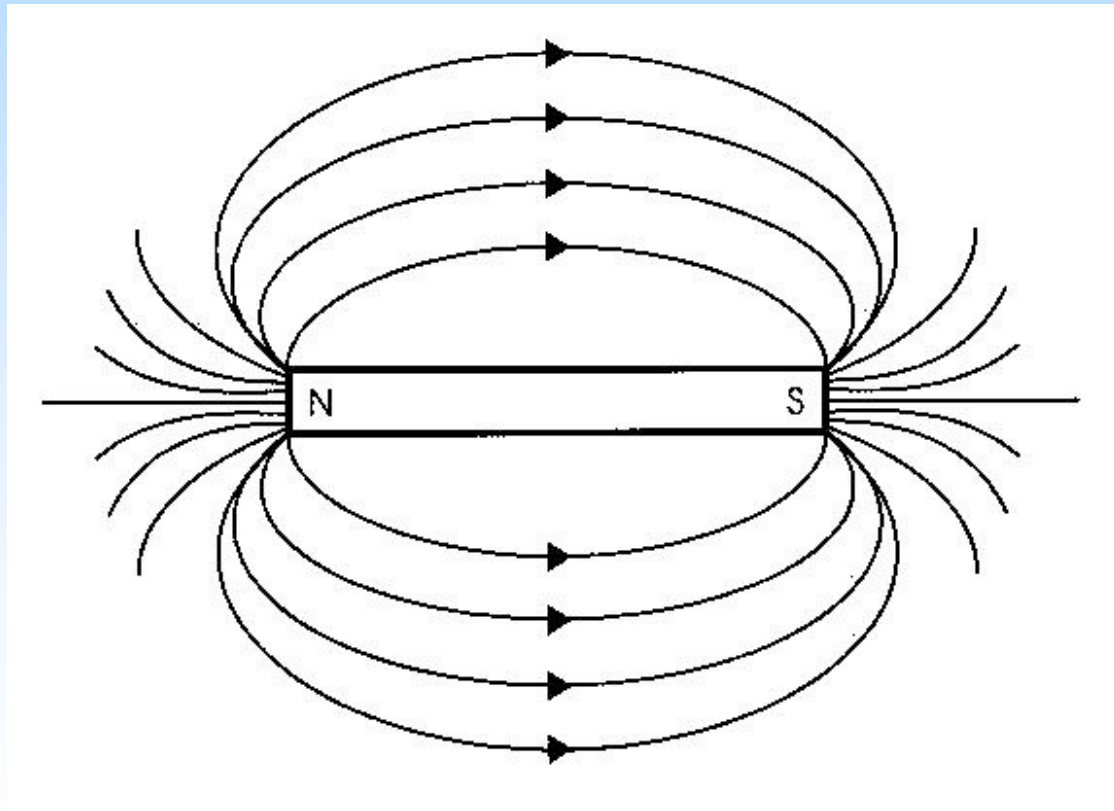
# The Corona: Continued...

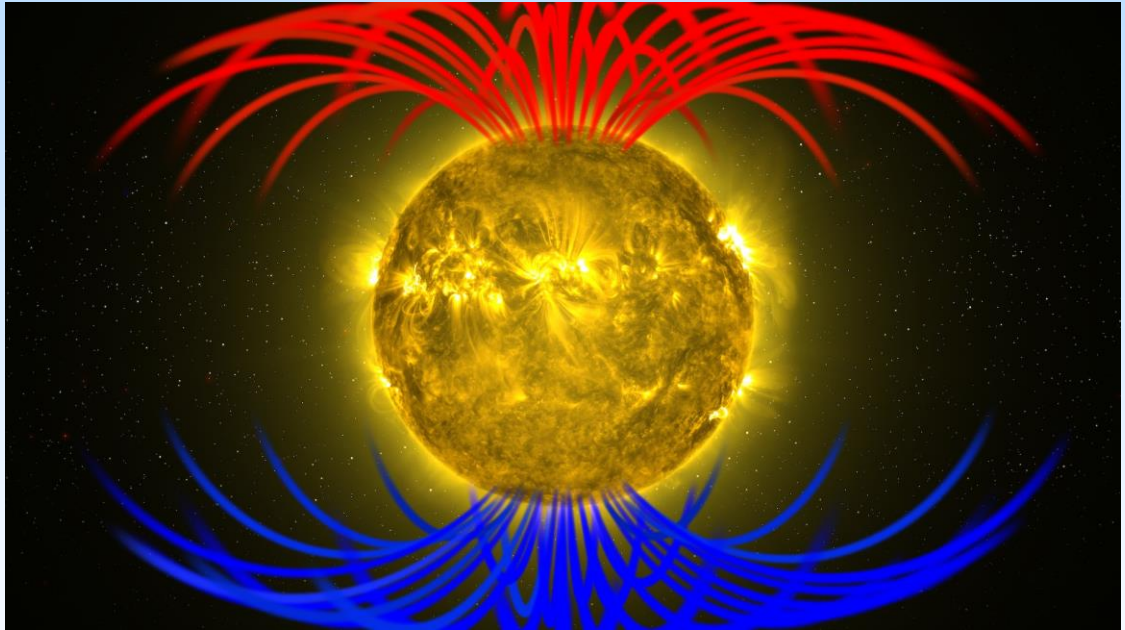
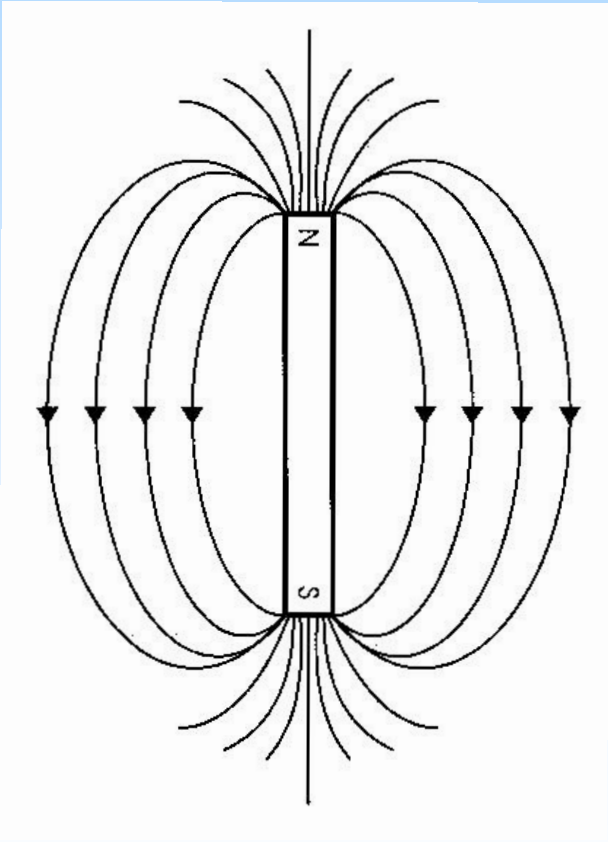
- The mystery spectral lines found to be due to very hot (“highly-ionized”) familiar elements ~1940.

So this was a sloooow process: 1869 eclipse observations, and 1939~1943 explanation!!

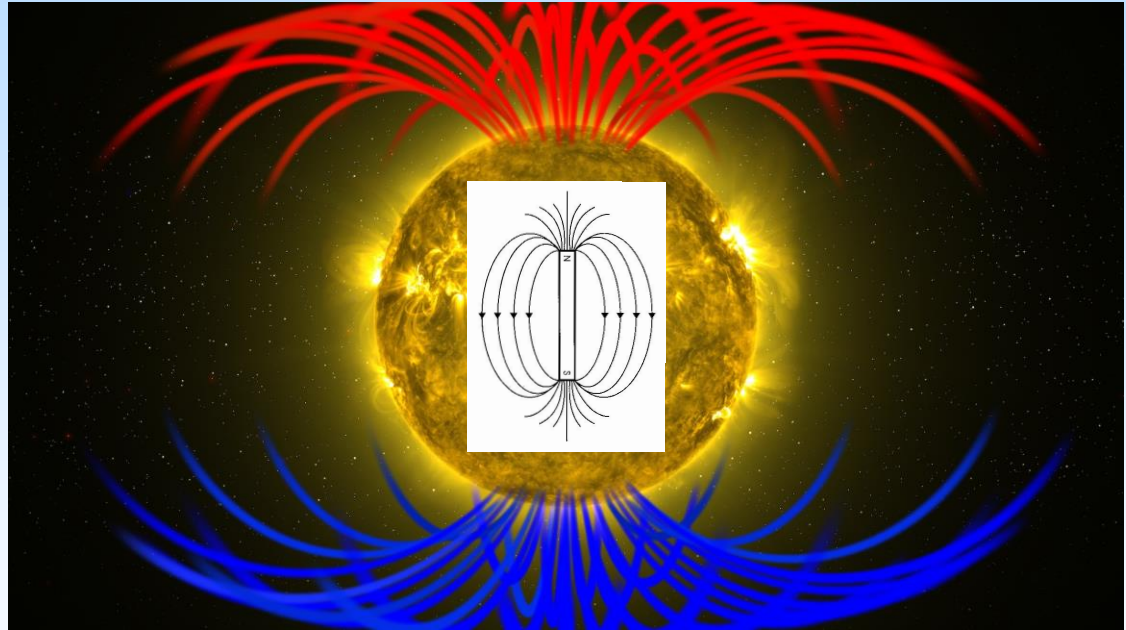
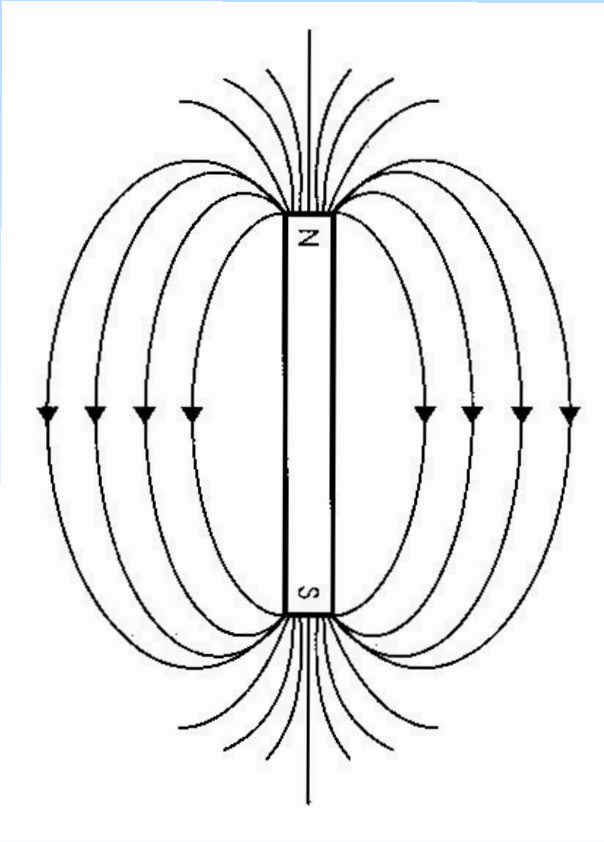
- Structure of the corona: late 1960s and 1970s observations from balloons, Skylab, etc.
- This structure due to the magnetic field.

***Magnetism*** is the key to why the corona is hot. (It is also responsible for many of the changing features of the Sun.)

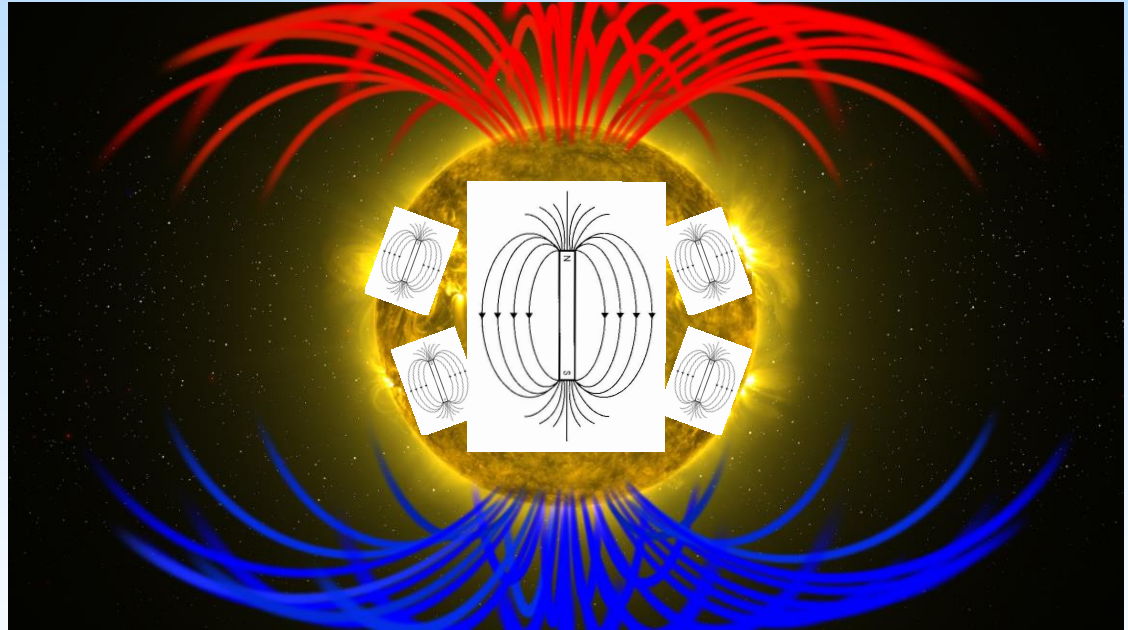
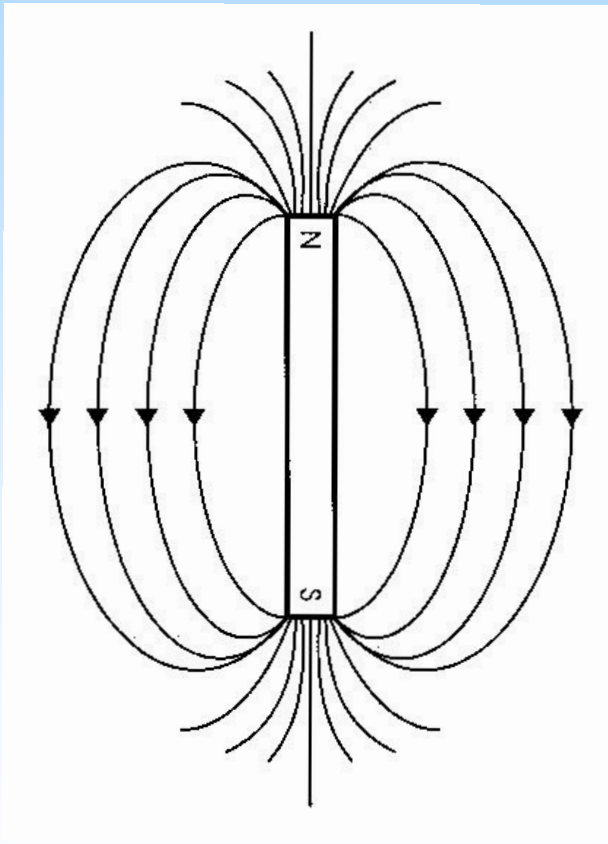


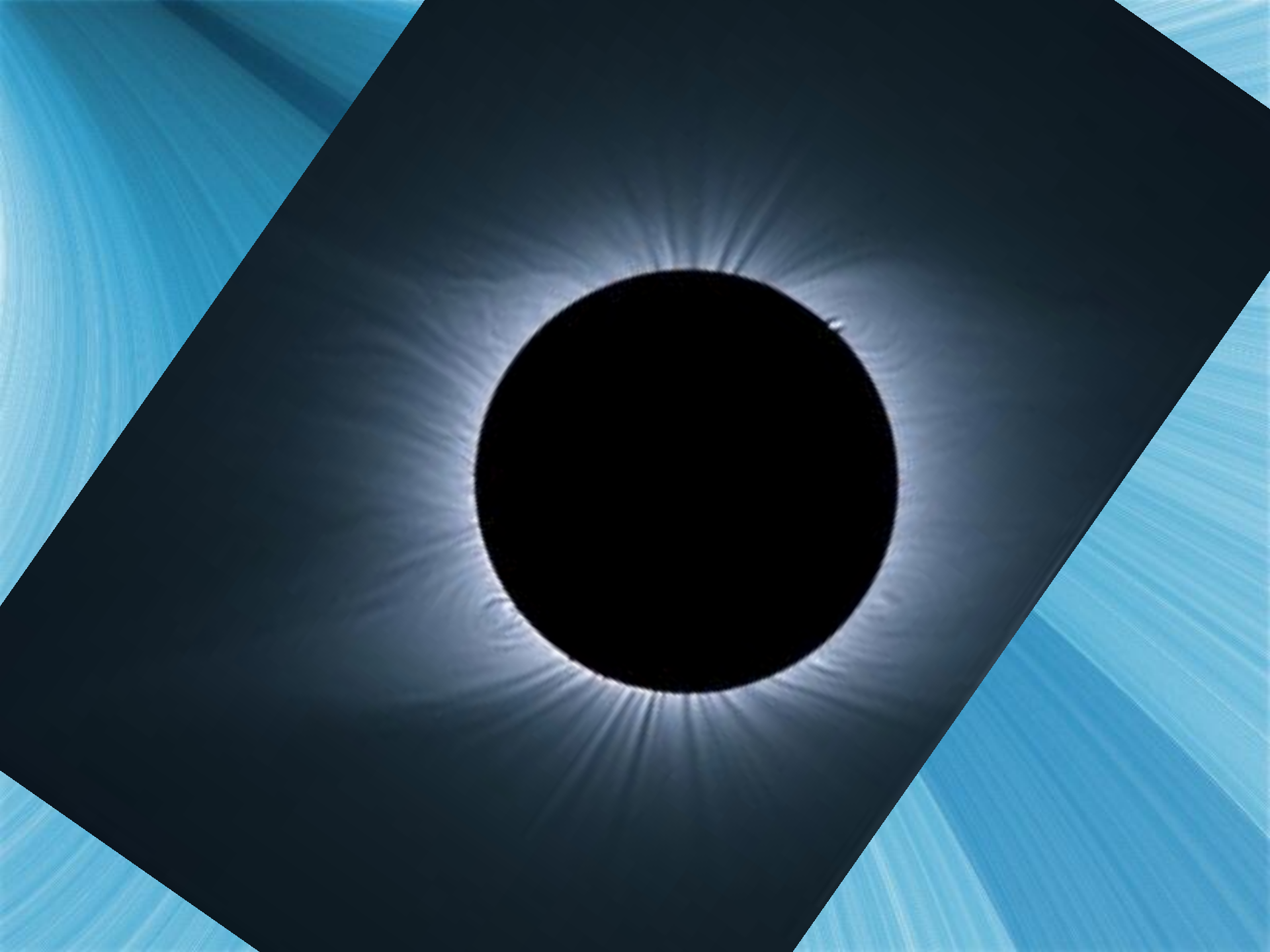


***Magnetism*** is the key to why the corona is hot.



*Magnetism* is the key to why the corona is hot.







# A Key Objective of Solar Physics:

Unravel details of how the magnetic field heats the corona!

- This is one goal (direct or indirect) of many eclipse studies.
- Also, many other stars have hot coronae, and thus understanding the heating of the Sun's corona tells us about other stars too.



















20 May 2012 22:35:02 UT



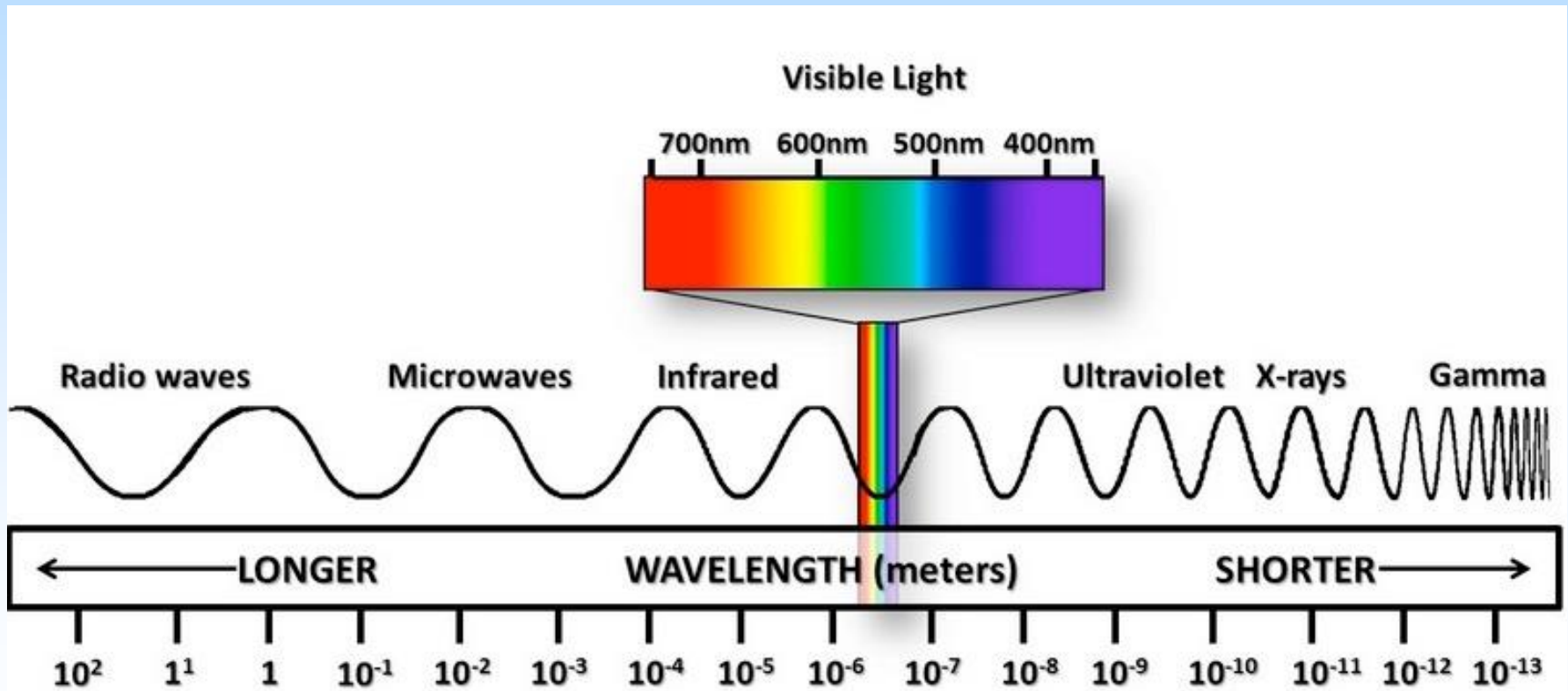
20 May 2012 22:35:22 UT

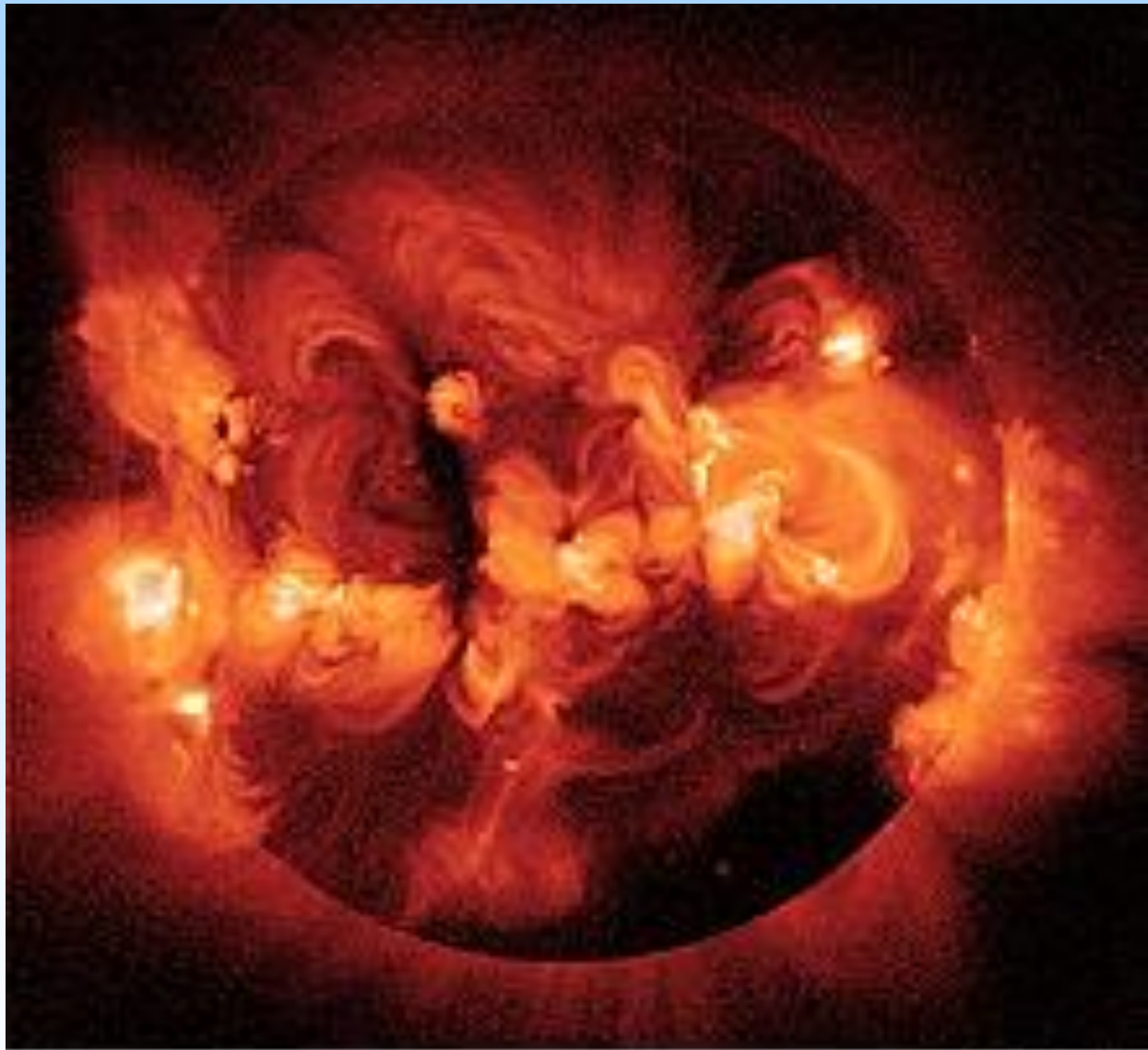






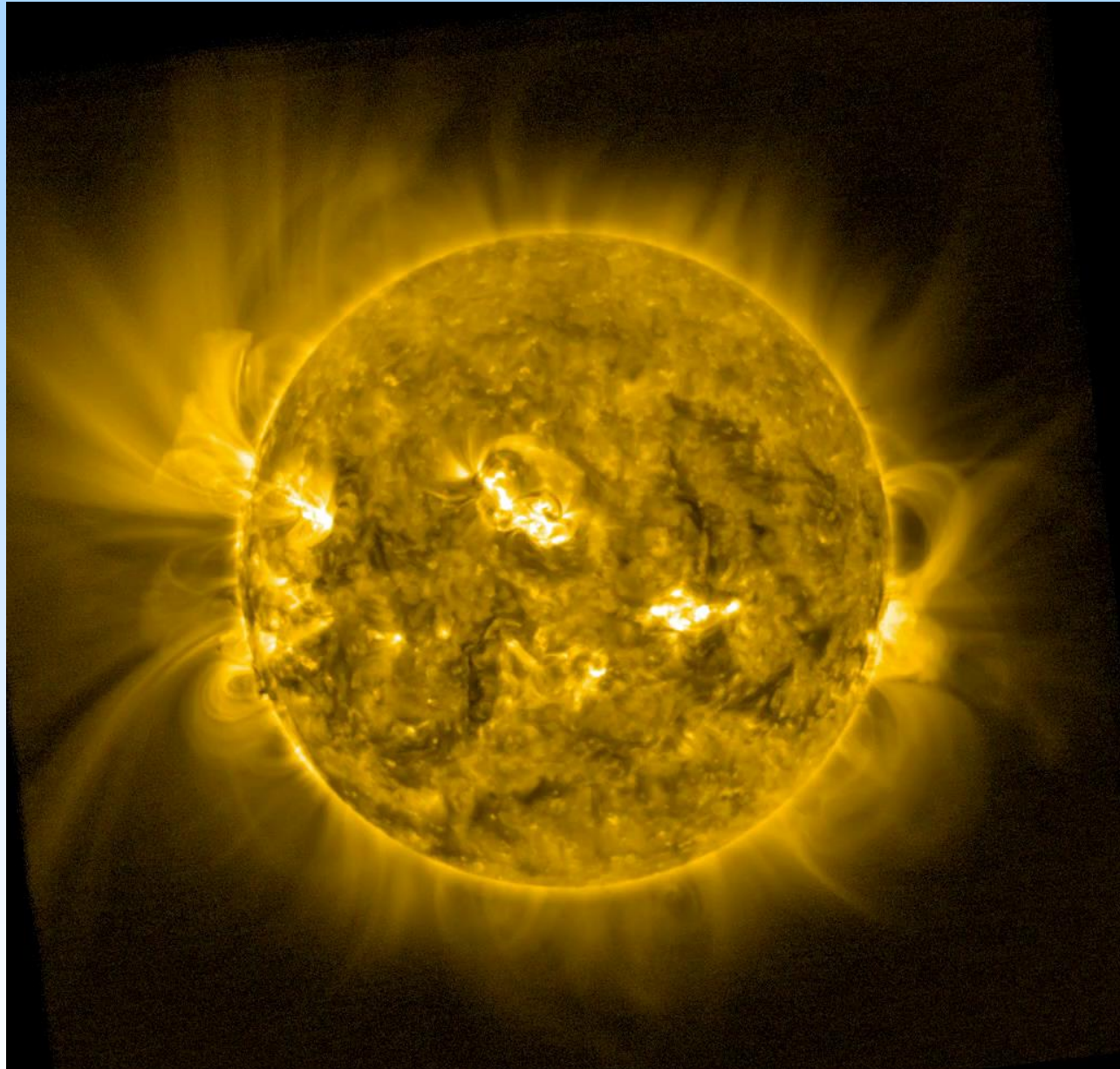
We have to go to *space* to see the Sun's outer atmosphere with regularity.





NASA

The Corona from Yohkoh/SXT



PROBA2/SWAP 17.4nm 2014-06-28 01:15:35



# The Corona

- Expected to be cool, but found strange spectral lines, first during 1869 eclipse.
- Many explanations considered, including a “new” element: *coronium*.
- **But this didn't work....**