Lecture 3.5 The Sun

Quick Solar Facts

- mass: ______________ earth masses
- diameter: ______________ earth diameters
- density: __________ g/cm$^3$
- distance: __________ light-minutes
- surface temperature: __________ K
- core temperature: __________ K

The sun is composed primarily of Hydrogen and ______________ with many trace elements. The most populous of the trace elements is ______________.

Photosphere

The photosphere is the part of the sun that we see when looking at it. The photosphere is very thin being only about __________ km thick. The surface temperature of the sun listed is the temperature of the photosphere. Some features of the photosphere are:

- ______________ which is the dynamic, “grainy” appearance of the sun’s surface
- __________ darkening which reflects the temperature gradient near the surface of the sun

Chromosphere

The chromosphere is the layer of the sun above the photosphere. It is fainter than the photosphere by a factor of about __________ and so we don’t typically see it relative to the brightness of the photosphere.

It is about ______________ km thick and its temperature is a little bit __________ than the photosphere’s temperature. Features include:

- brilliant ______________ lines (Balmer lines to be specific) which gives this layer its name
- fast, short-lived, hyper-active filaments of gas called ______________

Corona

The outer atmosphere of the sun. It extends out many solar radii and smoothly fades into the solar wind. Its temperature is much __________ than the photosphere reaching about ______________ K. This counter-intuitive phenomena is believed to be caused by ______________ heating.

The corona has an even lower density than the already low density photosphere and chromosphere of about ______________.
are colors seen in the earth’s atmosphere caused by excited atoms in the atmosphere that trace their excitation to solar activity of the sun.

**Sunspots**

Sunspots are dark spots seen on the sun. They appear dark because they are a bit cooler than the surrounding gas. Sunspots tend not to appear near the the sun’s poles but appear more close to the solar equator.

Sunspots are believed to be a magnetic phenomenon. One evidence of this is the observation of a strong __ __ effect in sunspots. Another clue is that sunspots tend to come in pairs and magnets always come in pairs (a north and south pole).

The sun doesn’t rotate all at the same rate (as opposed to the earth). This is called __ __ rotation. The __ __ model suggests that sunspots are a result of the “twisting” of the magnetic fields caused by this rotation.

Sunspot activity cycles through an __ __ year cycle. Some evidence suggests that solar activity effects the earth’s climate. One example is the __ __ minimum which was a (yet unexplained) period of little to no sunspot activity and in which at least part of the earth was much colder than average.

**Other Solar Activity**

- __ __ are loops of gas trapped in magnetic fields. Some are “low hanging” and stay around awhile and are called __ __. Others tend to break and collapse sometimes eruptively so.

- __ __ are large explosions on the surface of the sun. Sometimes associated with the two sunspot poles colliding or an eruptive prominence, whatever the cause, these fast, explosive bursts are very powerful.

- coronal __ __ ejections are events in which massive amounts of the suns lower corona are “pushed” outward. CME’s are often (but not always) associated with solar flare events.