Visit to KP 0.9m, Nov 13, Wed

• Van leaving TOCC at 4 PM. Bring a warm jacket!
• We will eat dinner in astronomer’s cafeteria when you arrive, then go directly to telescope.
Observing at 0.9m at Kitt Peak
The 0.9m telescope, where we will be observing. The telescope is a light bucket: we need a camera to catch the light.

The camera is much like the digital camera you may have. The image is recorded by a CCDs, or Charged Coupled Devices: this is done from the control room...
There is a computer for the telescope control, and two separate computers to control the instrument: in our case a camera called Half Degree Imager (HDI).
What is a “digital” image?
- some of you may remember film...
today, the image is saved digitally, in “pixels”

Zoom in on the moon, in this image from my iphone
Now for a demo on how a CCD works

- An electronic chip consists of pixels arranged in columns and rows. The shutter is opened to start the exposure.

- Light falling on each pixel is converted to an electronic charge. When the shutter is closed, the charge must be transferred electronically (by varying voltages) to a point where the charge is converted to a number, representing the amount of light that fell in that pixel.
Now for a demo on how a CCD works

- We will represent the photons of light with Skittles
- Each person responsible for counting the number of Skittles in their pixel and entering it on the board!

Questions: how do we get a color image?
A close-up of the computer screen with a raw image, 2048 by 2048 pixels:
So, how do we sort out different colors, and then make a pretty picture?

Filters!
This image of the Eagle Nebula was taken at the 0.9-meter telescope on Kitt Peak with the NOAO Mosaic CCD camera.
So how does your camera do it in only one shot?

Ok, why do astronomers make such a production of this?
Astronomers want to measure the amount of light of each color:

filters help us measure the color, thus temperature, of a body:
Now what is collected with a red filter:

The U, B, V, and R filters are standard filters commonly used in astronomy research.
And finally a blue filter:
The schedule shows astronomers using different instruments: another is a Spectrograph plus camera.
let’s investigate spectroscopy

A spectrum can be produced with either a prism or a grating: this one was made with a grating (Plastic film with very closely ruled lines)

First, look at an incandescent bulb
Why would astronomers want to look at the spectrum of astronomical objects?

Three cases:
- hot filament in lightbulb,
- hot gas...
- and a third that we can’t easily create: gas in front of hot filament
Sunlight, and two gasses: which seems more important in the solar spectrum?

- Sunlight
- Hydrogen gas
- Helium gas
And finally, Fiber optic instruments:
Wed Nov 13:

1. A Van (Grace Johnson driving) will leave TOCC at 4 pm. Bring warm jacket!
2. On arriving, we will go to the cafeteria for dinner with other astronomers.
3. We will head up to the 0.9m telescope, with Flynn, to start (I will have been there in the afternoon to do setup)
4. We will take turns observing: the group will split, and visit other telescopes
5. We will finish about 10 PM, and drive back (I will lead a no-headlights group)

Reminder: