

Astro 426/526

Fall 2019

Prof. Darcy Barron

Lecture 21: Spectroscopy

Reminders

- Homework #3 due **Wednesday, November 13 at 4:00PM**

Project Update

- Research-style paper summarizing your methods and results is due **Monday, November 25 at 4pm**
 - Group submission on Learn (as pdf or word document)
 - I will make sure to allow unlimited submission attempts
- All three groups will give in-class presentations on Wednesday, December 4 (25 minutes per group)

Syllabus update

- No class Wednesday November 27 (Wednesday before Thanksgiving break)
- 6 regular classes left, covering material from *Measuring the Universe*
 - Today, Wednesday Nov 13 (spectroscopy: Chapter 6)
 - Mon Nov 18, Wed Nov 20 (mm, sub-mm: Chapter 7)
 - Monday November 25 (TBD)
 - Monday December 2 (TBD)
- Take-home final will be handed out at final class (Wednesday Dec 4), due by 12pm Wed Dec 11

Photometry

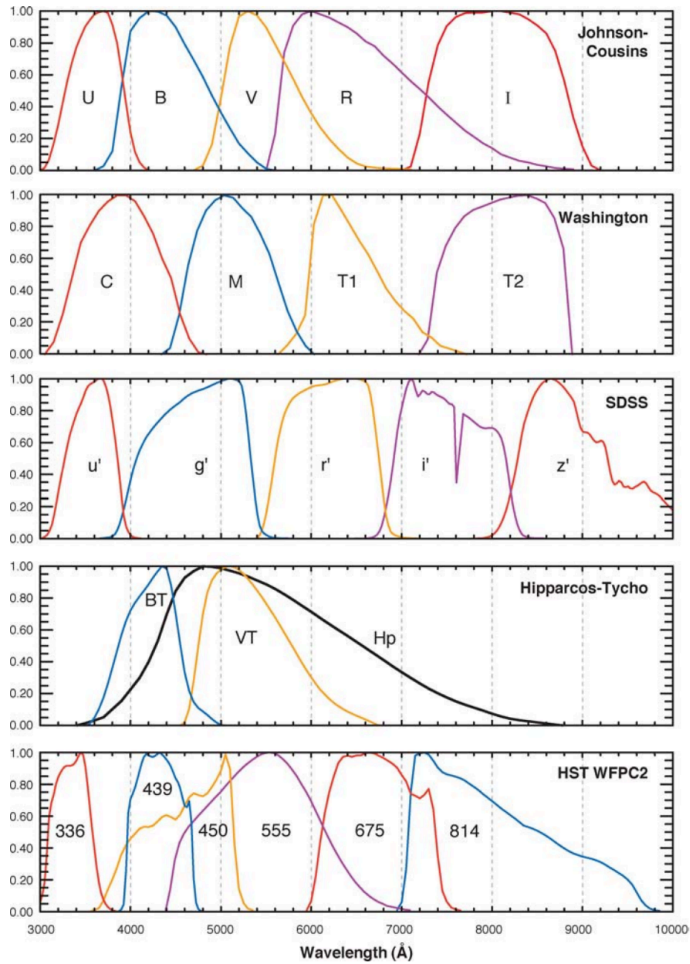
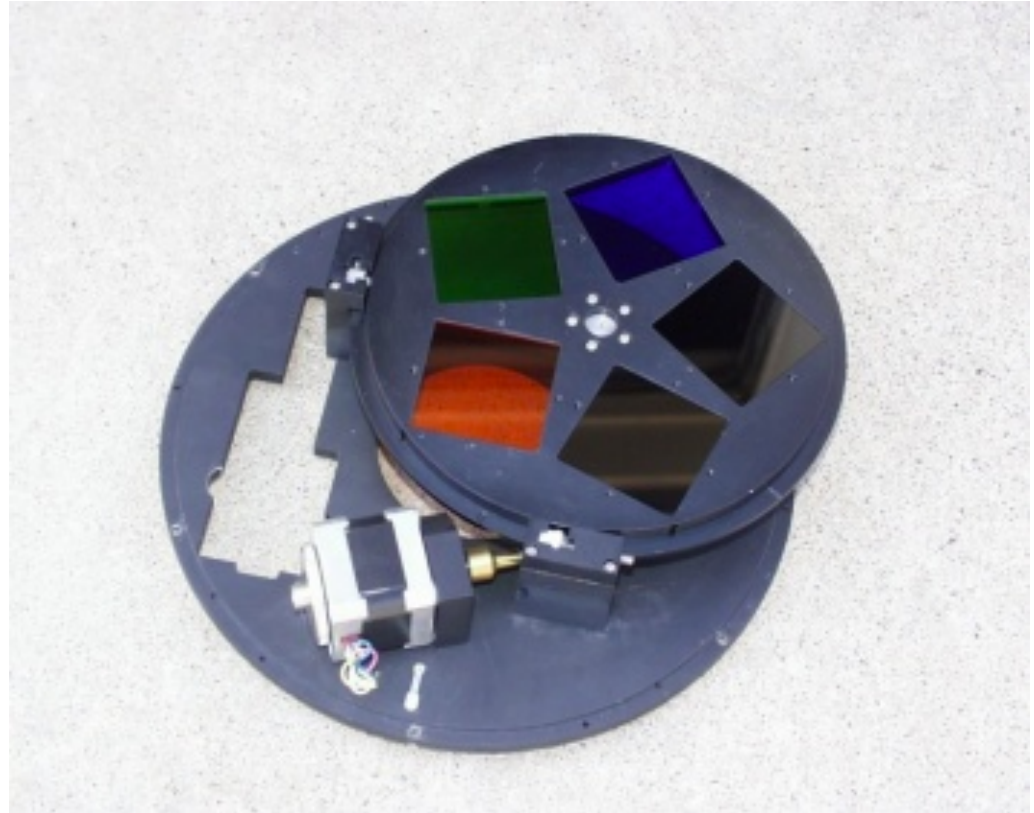
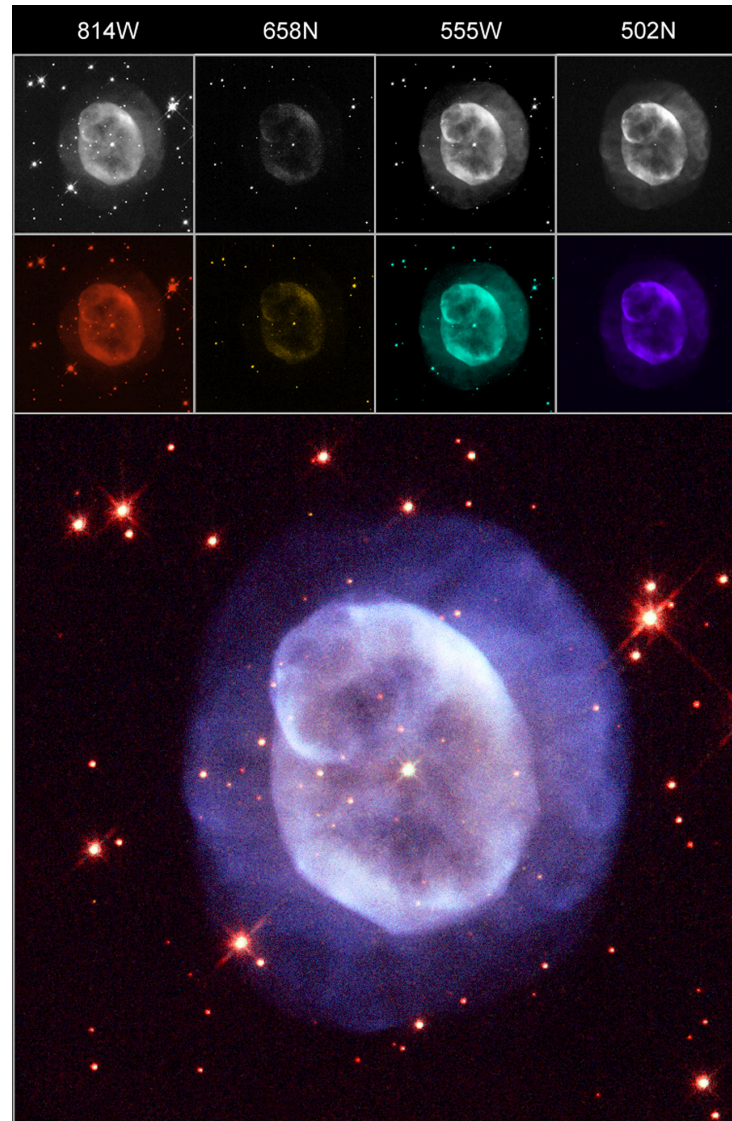


Figure 1 Schematic passbands of broad-band systems.



Photometry



<https://www.spacetelescope.org/images/heic0412b/>

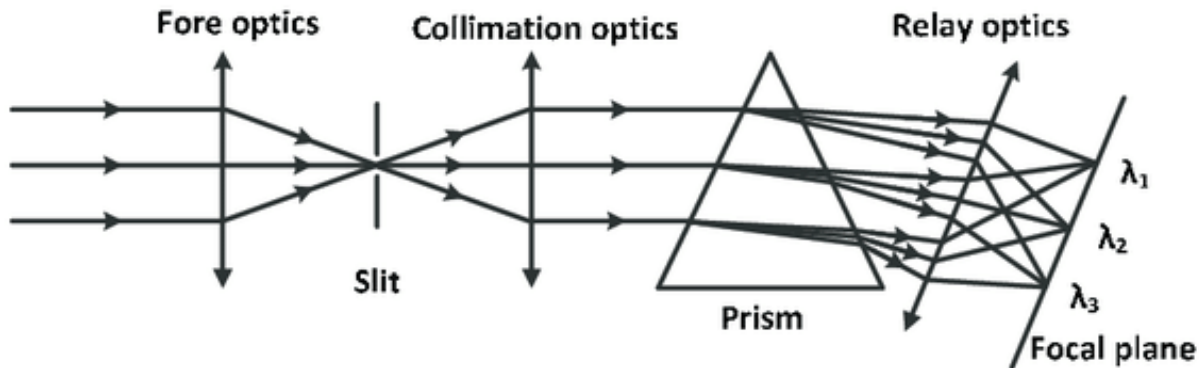
Spectroscopy

- Define R: resolution of spectral information
 - $R = \lambda / \Delta\lambda$
- For photometric systems, $R < \sim 10$
 - Benefits: sensitivity (power/flux $\propto \Delta\lambda$), simplicity (filter wheels)
 - Works for spectrally simple objects, or objects with a very well parameterized spectral signature
 - Stars, some galaxies
 - Data is inherently reduced, to facilitate analysis of large data sets, looking for trends
- Spectroscopy: $R > 10$
 - Looking at spectral features

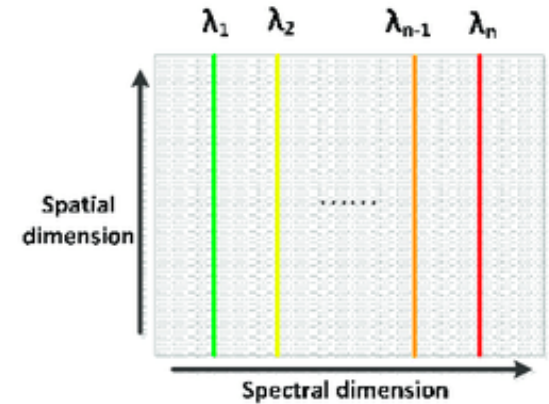
Spectroscopy

- Three ways to measure light spectroscopically
 - Differential-refraction based systems (e.g. prism)
 - Interference based systems (e.g. diffraction grating)
 - Bolometrically (measure energy of absorbed photon)
- Can also image with spectrometers, which produces a "data cube"
 - Full image along with spectral information at each point

Prism spectrometers



(a)



(b)

https://www.researchgate.net/figure/Schematic-of-a-typical-prism-spectrometer-a-Structure-of-the-prism-spectrometer-b_fig1_317133763

Grating Spectrometers