Notice PLEASE

- Charlie's mechanical pencil
- Peer Mentoring
- Thursday:
  - no Study Session
  - Science Colloquium
  - 21" telescope Thursday (6-8 pm)

Iridium Flares

Search period start: 21:53 Tuesday, 11 February, 2020
Search period end: 21:53 Tuesday, 18 February, 2020

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include daytime flares

Clicking on the time of the flare will give more details about the flare, including a sky chart.

Please note that the first generation of Iridium satellites are now being de-orbited and replaced with ones of a new design which do not produce predictable flares. This means there will be fewer and fewer flares, and eventually they will stop completely.

Time	Brightness	Altitude	Azimuth	Satellite	Distance to flare centre	Brightness at flare centre	Sun altitude
Feb 16, 06:04:57	-8.6	47°	355° (N)	Iridium 45	7 km (W)	-8.6	-13°

“Constraining the Neutron Star Equation of State with Gravitational Wave Events”

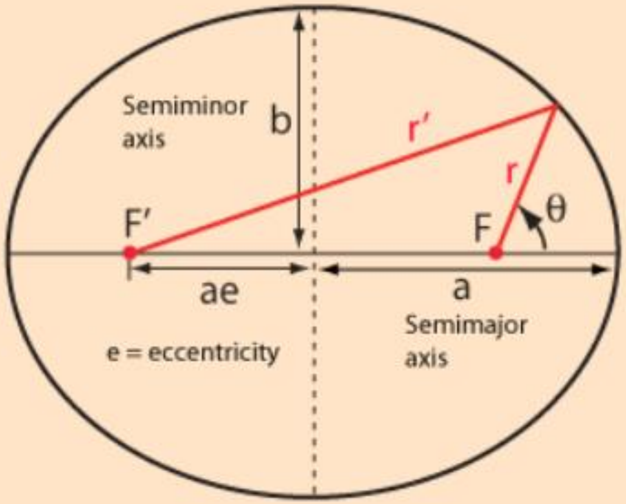
Ms. Carolyn Raithel (Steward Observatory)

Neutron stars provide a unique probe of the dense-matter equation of state (EOS), which in turn governs many astrophysical transients of interest today. Recently, a new avenue for studying the neutron star EOS has emerged: via the gravitational waves emitted during a binary neutron star merger.

In this talk, I will summarize what we have learned from the first two binary neutron star mergers and what we might hope to learn from future events.

Steward Obs.
weekly colloquium - Thursdays
(3:30 pm in room N210)
4:30 pm refreshments in the lobby

Problem
derive expressions for perihelion and aphelion



r:

$$r'^2 = r^2 \sin^2\theta + (2ae + r\cos\theta)^2$$

Using the trigonometric identity

$$\sin^2\theta + \cos^2\theta = 1$$

this reduces to

$$r'^2 = r^2 + 4ae(ae + r\cos\theta)$$

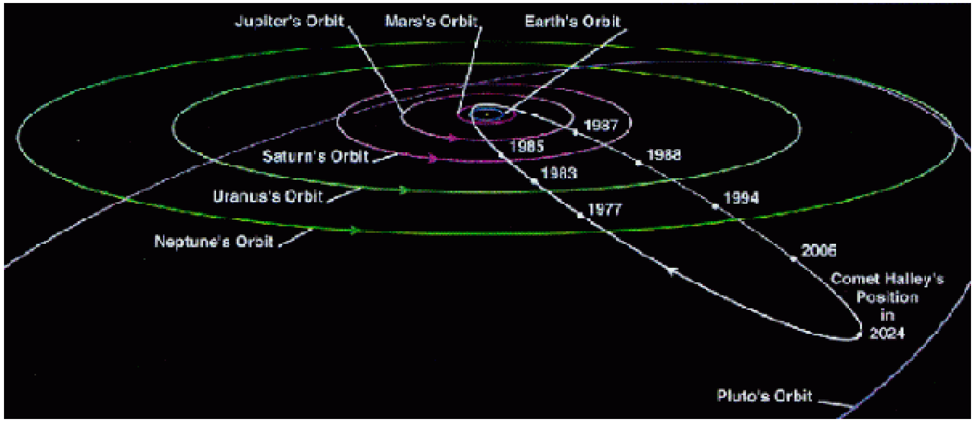
Using the equation for an ellipse, an expression for r can be obtained

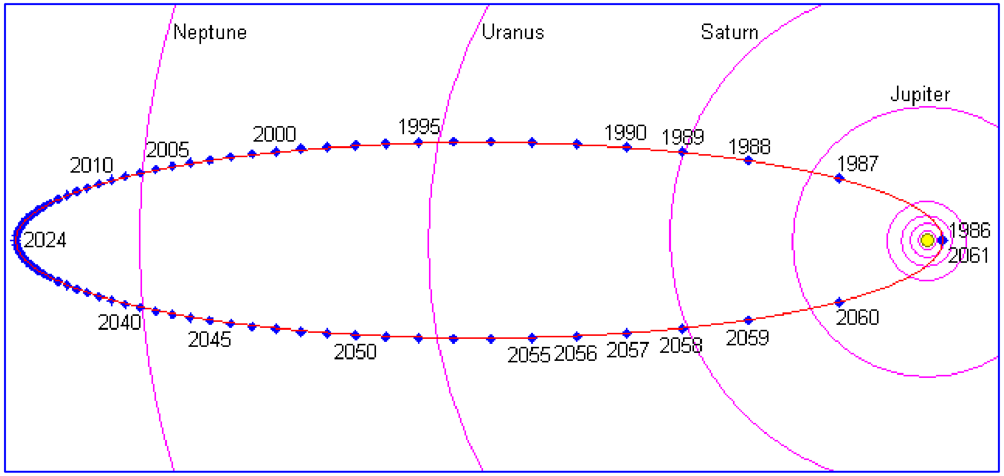
$$r = \frac{a(1-e^2)}{1+e\cos\theta} \quad \textit{for} \quad 0 \le e < 1$$

Problem

Halley's comet

Semi-major axis	17.834 AU
Eccentricity	0.96714
Orbital period	75.32 yr
Mean anomaly	38.38°
Inclination	162.26°
Longitude of ascending node	58.42°
Argument of perihelion	111.33°

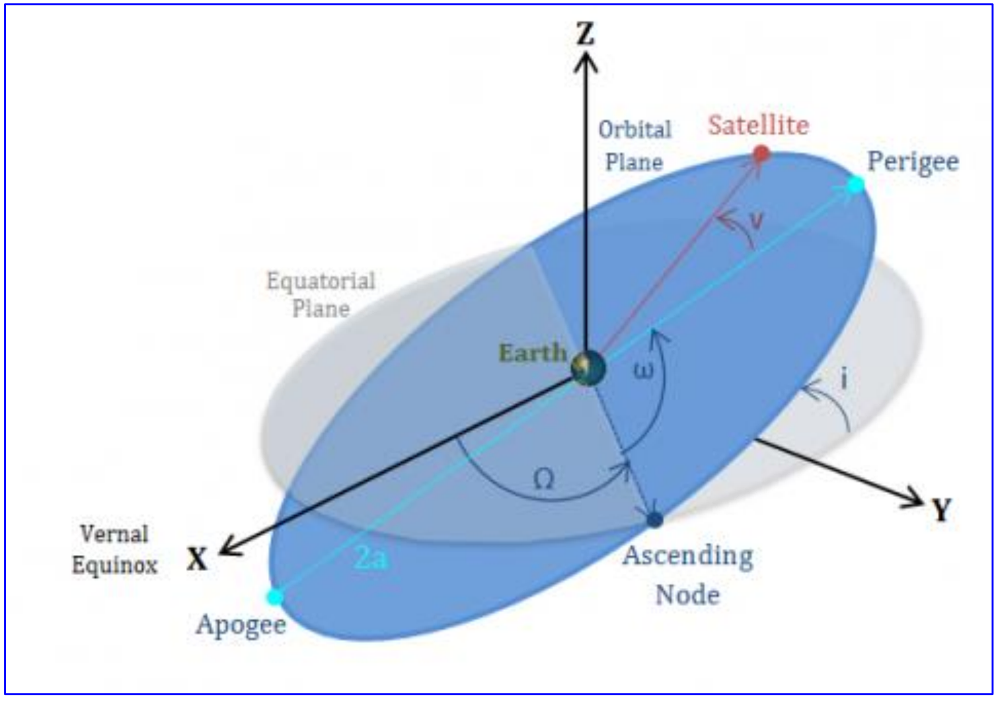




aphelion = ?

perihelion = ?

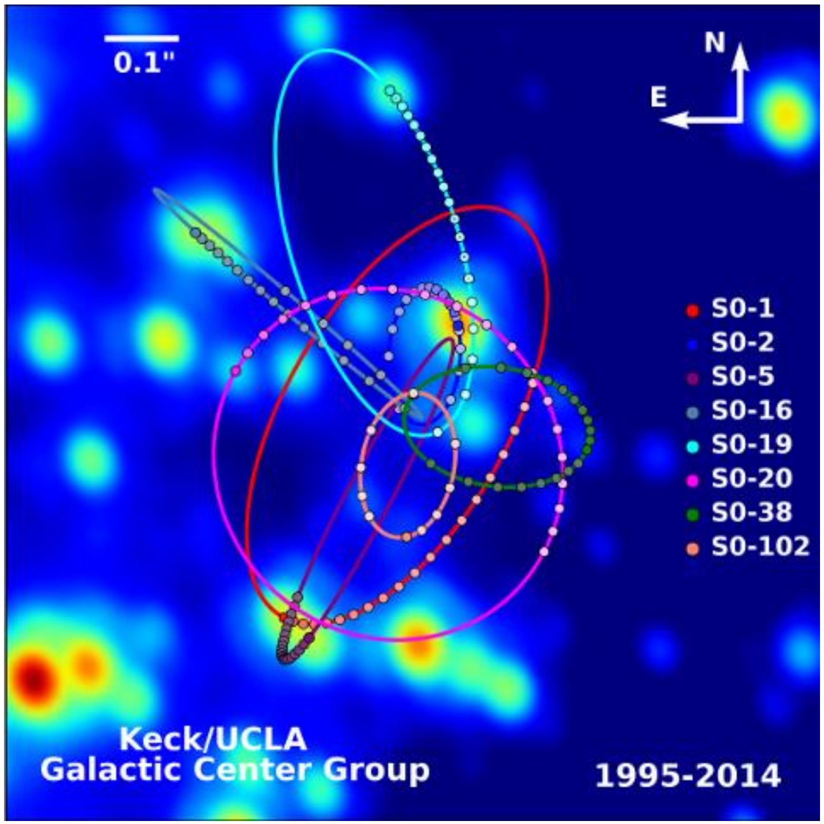
Orbital elements

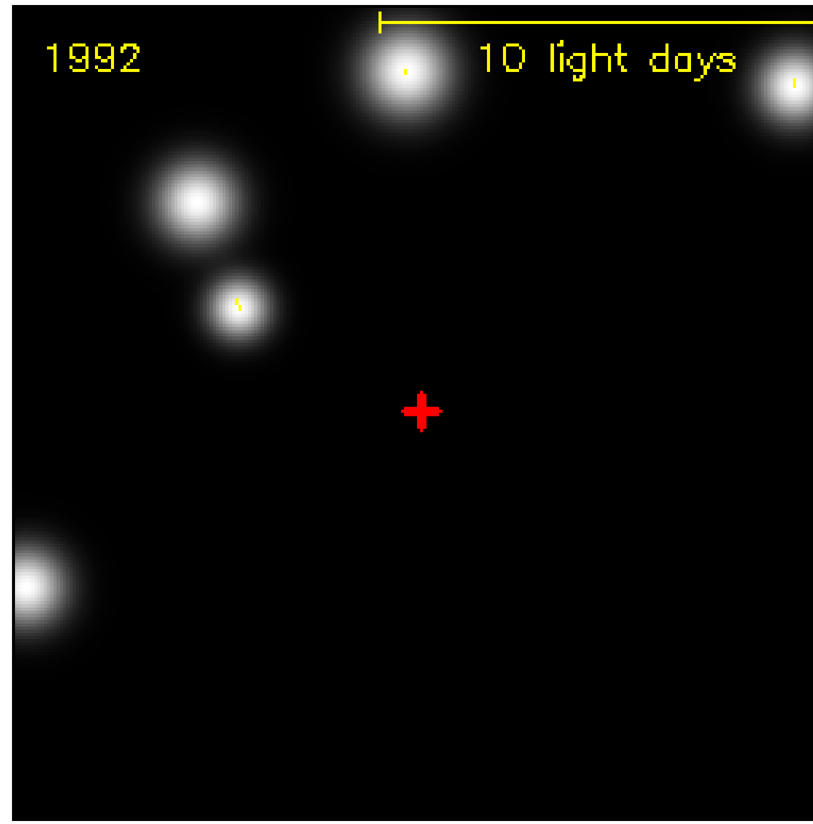


- size & shape of orbit
  - a, e
- orientation of orbital plane
  - i, Ω
- orientation of ellipse in the plane
  - ω
- position of object
  - ν

Stars Orbiting the Black Hole at the Center of Our Milky Way Galaxy

Do Kepler's Laws work there?





Virial Theorem

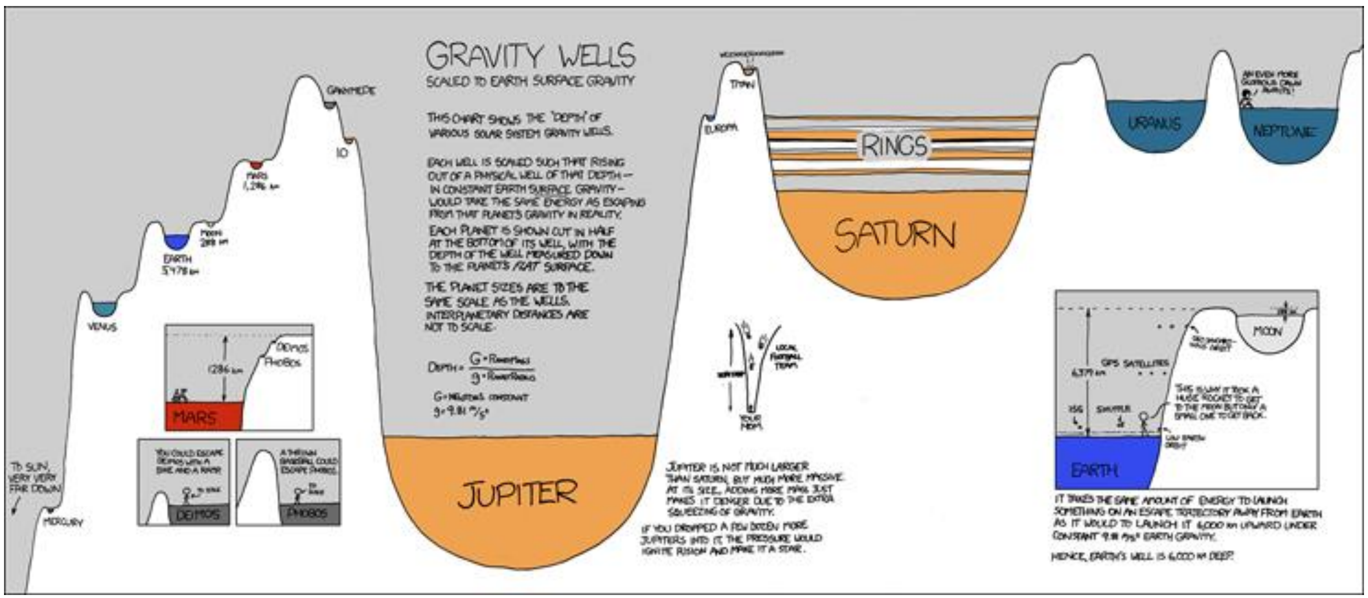
- For any system of particles bound by an inverse-square force, the time-averaged kinetic energy <T> and the time-averaged potential energy <U> satisfy $2\langle T\rangle + \langle U\rangle = 0$

- What assumptions?
- Why is U negative?

- Assumes a “bound” system
  - In equilibrium, neither expanding nor contracting
  - only gravitational forces

- Ignores rotation
- We will apply to globular clusters and the Coma cluster of galaxies

"Potential Wells"



Virial Theorem

$$2\langle T \rangle + \langle U \rangle = 0$$

- **$2T = Nmv^2 = Mv^2$**

- **m is individual mass**
- **N is number of objects with mass (m) and average speed (v)**

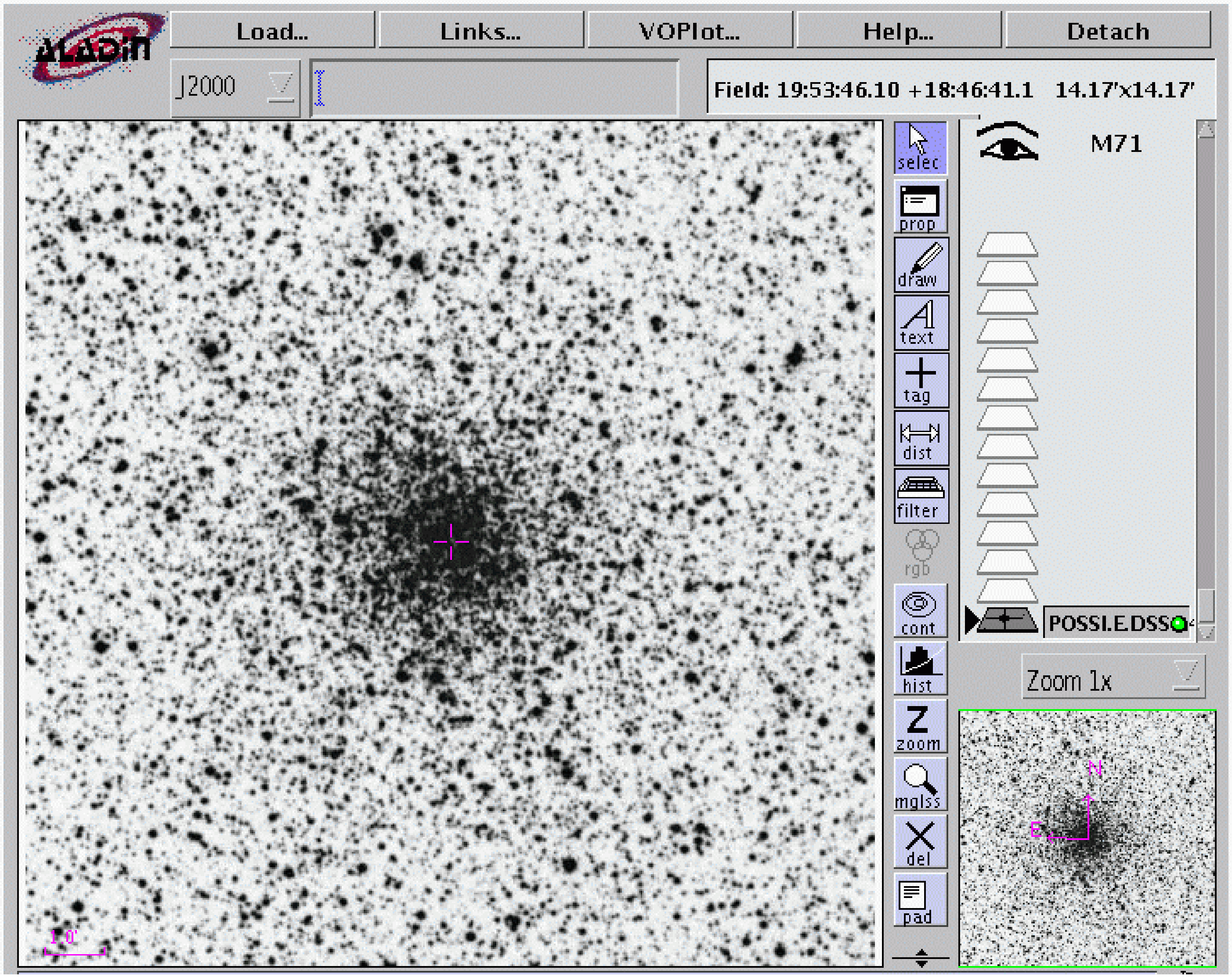
- **$U = -\alpha GM^2/R$**
- **α is a constant depending on how the mass is distributed**
- **R is the object's radius**

- **$Mv^2 = \alpha GM^2/R$**
- **$M = v^2R/\alpha G$**

Problem
globular star cluster (M71)

Calculate the Virial Mass of Globular Star Cluster M71

distance = 3.8 kpc



Homework #12

Derive the potential energy of a collapsing sphere

- Work in teams of ~4-5 people:
  - Use white and chalk boards in room 204 and 208.