11/14/07

Astronomy in the News -

http://www.jaxa.jp/press/2007/11/20071107_kaguya_movie_e.html

Solar Twin discovered at McDonald Observatory

Mars is covered in tundra - permanently frozen water ice

Pic of the day - Tunguska, impact in Siberia in 1908

Two recent reports of especially massive black hole candidates orbiting stars.

One in relatively nearby spiral galaxy M33, 3 million light years away, 15.7 solar masses, companion 70 solar masses (announced October 17, 2007).

Another in a relatively nearby dwarf irregular galaxy, IC 10, 1.8 million light years away, 24 - 33 solar masses (announced October30, 2007).

Both challenge the theory that massive stars should blow off most of their mass in stellar winds.

All low companion mass systems are ***X-ray Novae***

Flare every few years to decades for months, like neutron star X-ray transients

Dwarf Nova-like accretion disk flushing instability

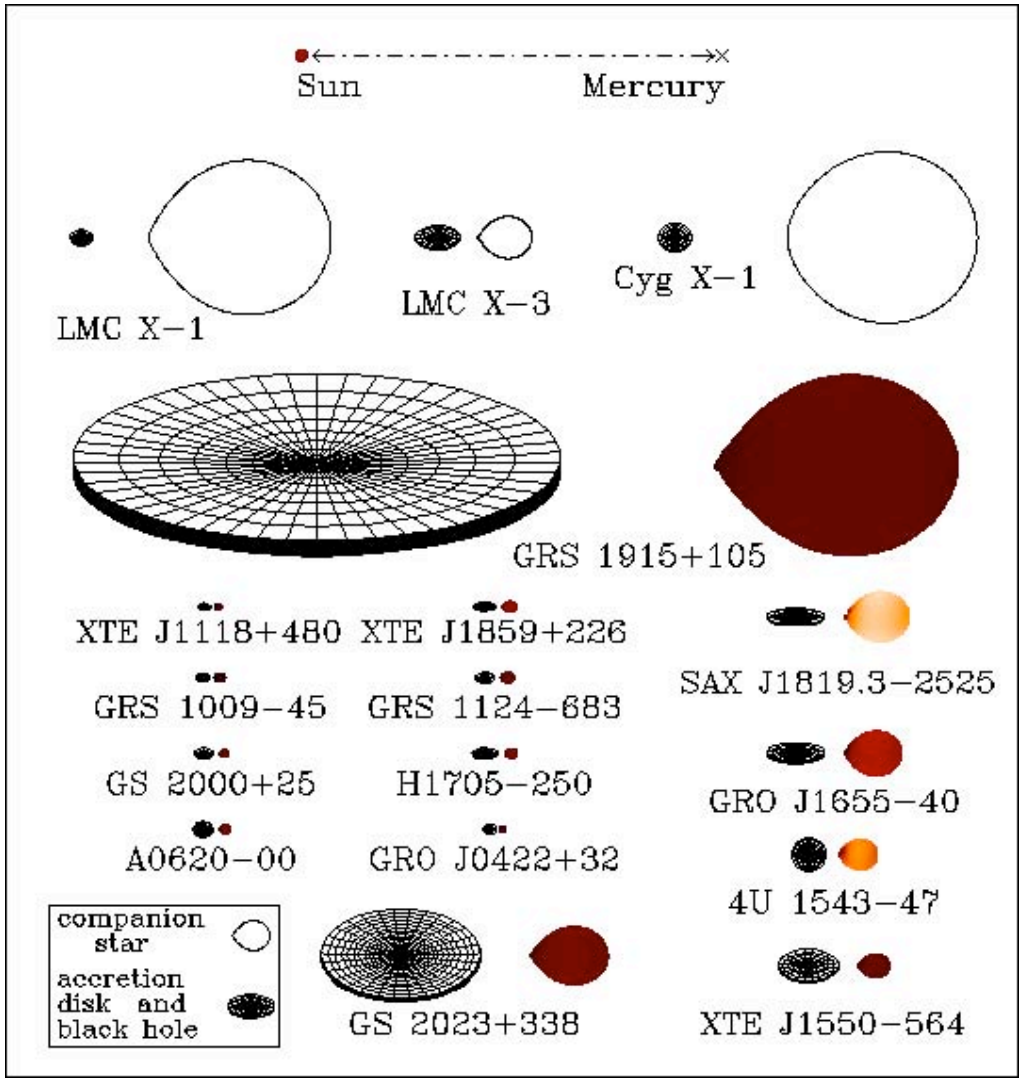
No black hole analog of nova or X-ray burster. Why not?

The black hole is black and the disk does not produce X-rays in the "off" state. There are billions of small mass stars in the Galaxy.

Do not notice these systems until they erupt!

There are probably 100 "sleeping" black hole systems that we have not discovered for every one we have. Perhaps 1000 such systems in the Galaxy (but 100 million more black holes!)

Examples of Black Hole Binary System Candidates



One Minute Exam:

The best candidate for a binary star system with black hole is:

A) One with a 30 solar mass ordinary star

B) One with a 1/2 solar mass ordinary star

C) One with a 70 solar mass ordinary star

D) Cygnus X-1

One Minute Exam

The X-ray flares from binary black hole systems are thought to be from the same basic physics as:

A) Dwarf Novae

B) Classical Novae

C) X-ray Bursters

D) X-ray pulsars

Often see jets during X-ray flare from black hole X-ray novae.

Some show “superluminal” motion

An optical illusion that occurs when the source of light moves near the speed of light, so chases its own emission.

These systems are called “microquasars” since some quasars with supermassive black holes have shown the same effect.

Another hint that these binary X-ray nova systems contain black holes.

In quiescent "off" state of X-ray novae, a hot, low-density ~ spherical region may form, ***Despite heat, little radiation is emitted because of low density.*** Heat is carried (advected) inward with the flow of gas toward the event horizon, rather than radiated away as for an accretion disk.

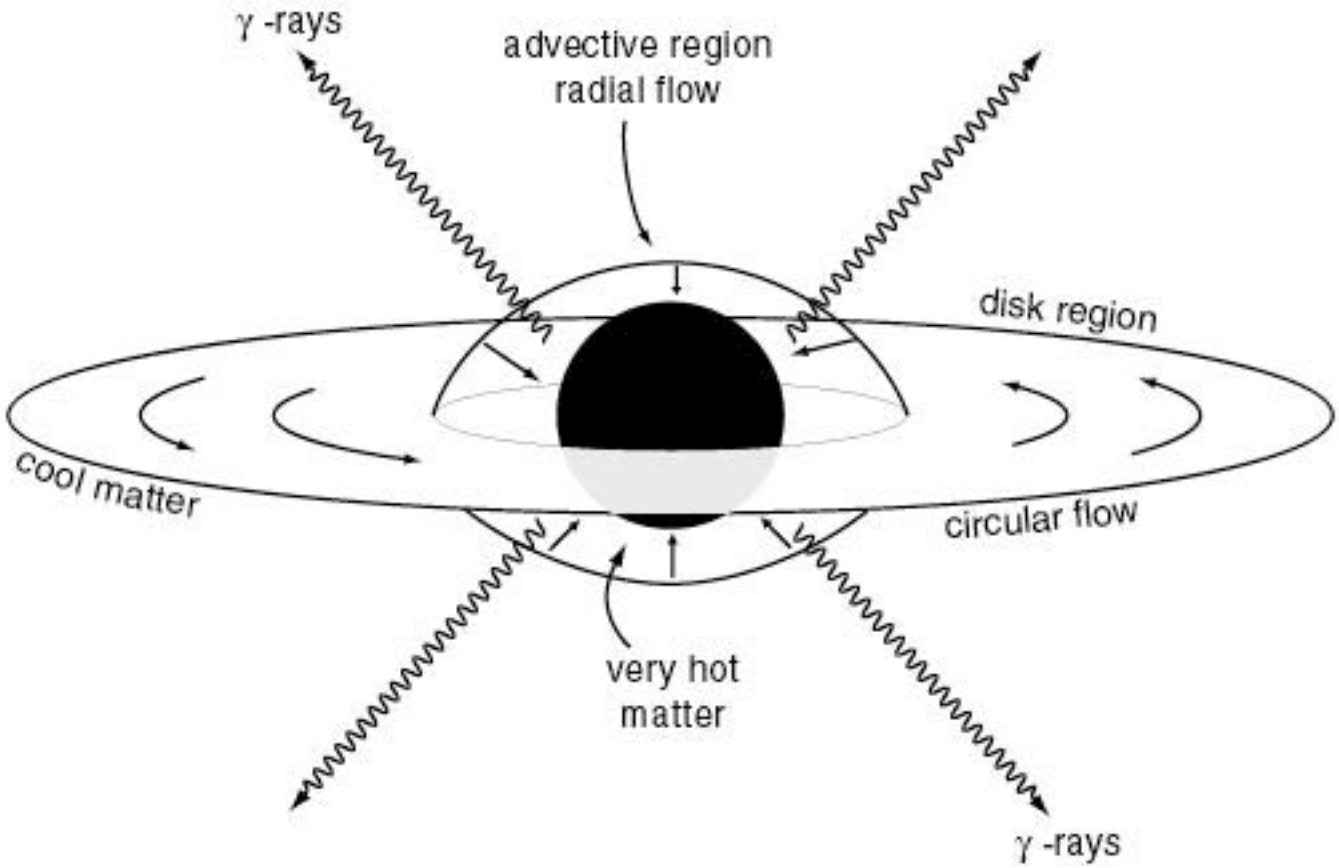
Very hot, $e^{\pm}$ electron/positron matter/anti-matter pairs may form (energy to mass, $E = mc^2$), annihilate to produce ***gamma-rays.***

Low density => low efficiency to produce radiation
=> ***low X-ray luminosity***

Only works for black hole, not for neutron star, X-ray radiation from ***surface*** of a neutron star would spoil the hot region.

Low X-ray luminosity, gamma-rays, ***clues that there is no surface***
=> ***possible proof of black hole!***

Fig. 10.1


γ -rays
advective region
radial flow
disk region
cool matter
circular flow
very hot
matter
γ -rays

Supermassive Black Holes

Long suspected in quasars, active galactic nuclei: huge power from small volume, billion solar mass black hole could do it.

More recently, proof that many (even most!) ordinary galaxies also have a supermassive black hole in their centers (dead quasar).

Again, do not yet see a "dark spot" but use Kepler's Laws, motion of many stars, gas ⇒ orbital period, separation

3.7 million $M_\odot$ black hole in our Galaxy UCLA [link - movie]

Up to billion $M_\odot$ black holes in quasars.

Jet from billion $M_\odot$ black hole in center of M87, large elliptical galaxy in the Virgo cluster (find Virgo!)