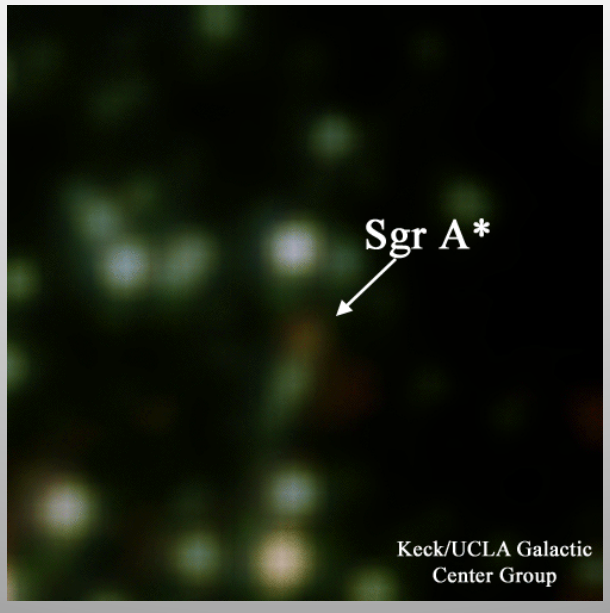
Galactic Center Supermassive Black Hole

- evidence is primarily *dynamical*
- motion of individual stars
- emission in several wavebands
  - radio (Sgr A*)
  - infrared
  - flares in X-ray



Total power in all these bands is quite small

Black hole in the Milky Way is "quiescent", not *currently* growing much in mass or radiating strongly due to accretion

Puzzle – plenty of gas near the black hole:

- dense molecular gas at ~few light years
- numerous young stars are losing mass in stellar winds in the black hole's vicinity

Why is this gas not being accreted?

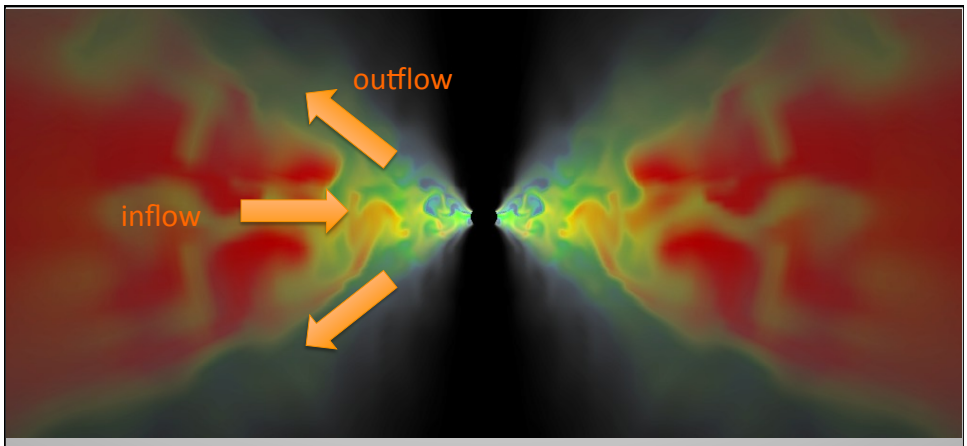
ANSWER 1: the Schwarzschild radius $R_S = 2GM / c^2$ is very small compared to the scale of these mass reservoirs

Gas has too much angular momentum to be directly accreted, how much gets accreted depends on the details of the friction ("viscosity") in the disk

Why is this gas not being accreted?

ANSWER 2: if the gas cannot cool, release of energy heats it up to extremely high temperatures

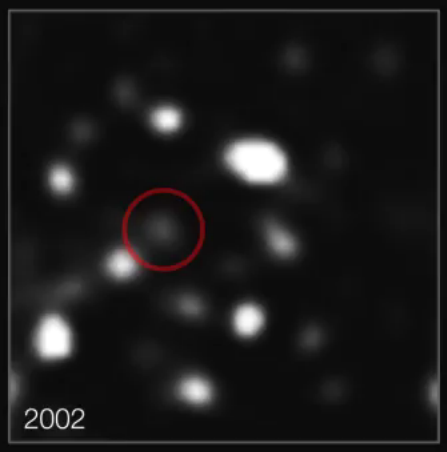
→ Hot gas can escape before it comes close to the event horizon



"Radiatively inefficient accretion"

- at low accretion rates gas is low density and cannot cool – heats up
- hot gas escapes, so only a small fraction of the already weak accretion reaches hole

May be about to change….

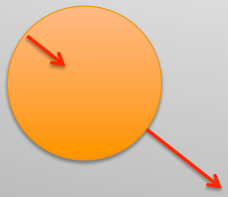


…observe a gas cloud falling in toward Sgr A*

Properties of the cloud are estimated to be:

- mass of about 3 Earth masses
- closest approach ~3000 Schwarzschild radii
- reached in summer 2013

Unless the cloud surrounds a massive object, tidal forces will destroy it



Tidal force: the *difference* in gravitational force caused by fact that the near side of the cloud is closer to the black hole than the far side

What will happen?

Unclear – depends on the nature of the cloud and how it interacts with the hot gas already surrounding the black hole

- cloud likely to be disrupted
- some of the gas will be gravitationally captured by the black hole
- may accrete producing much stronger X-ray emission