Intermediate Mass Black Holes in Minor Mergers

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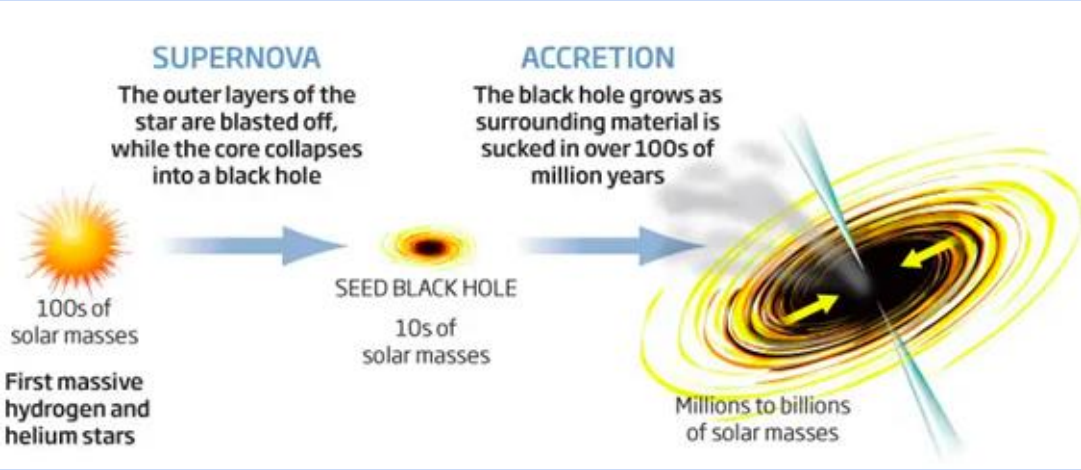
What are black holes?

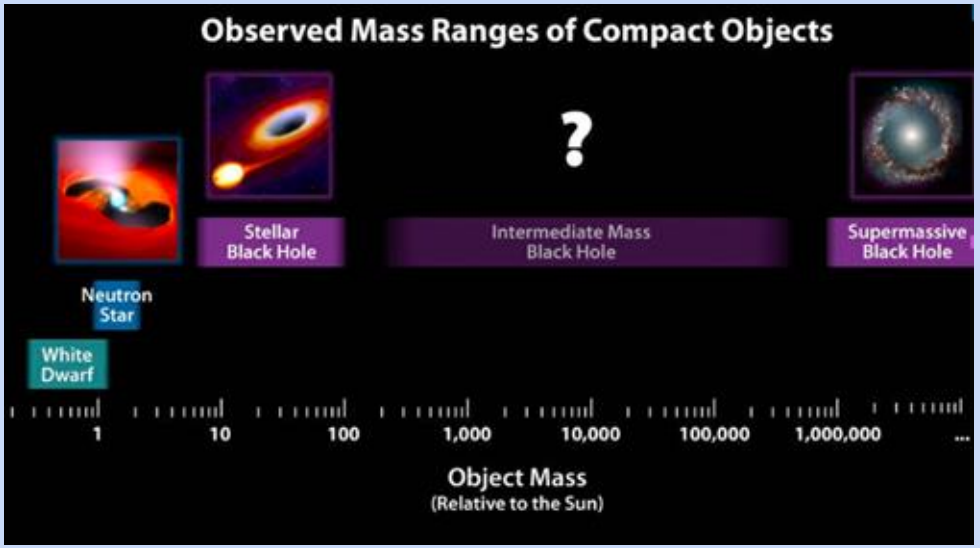
- Stellar mass black holes have masses between one and one hundred solar masses
- Formed from the collapse of a massive star
- Supermassive black holes can be millions to billions of solar masses
- Reside at the center of galaxies
- Mergers and accretion allow small black holes to achieve supermassive size



Credit: NewScientist

What are intermediate black holes?

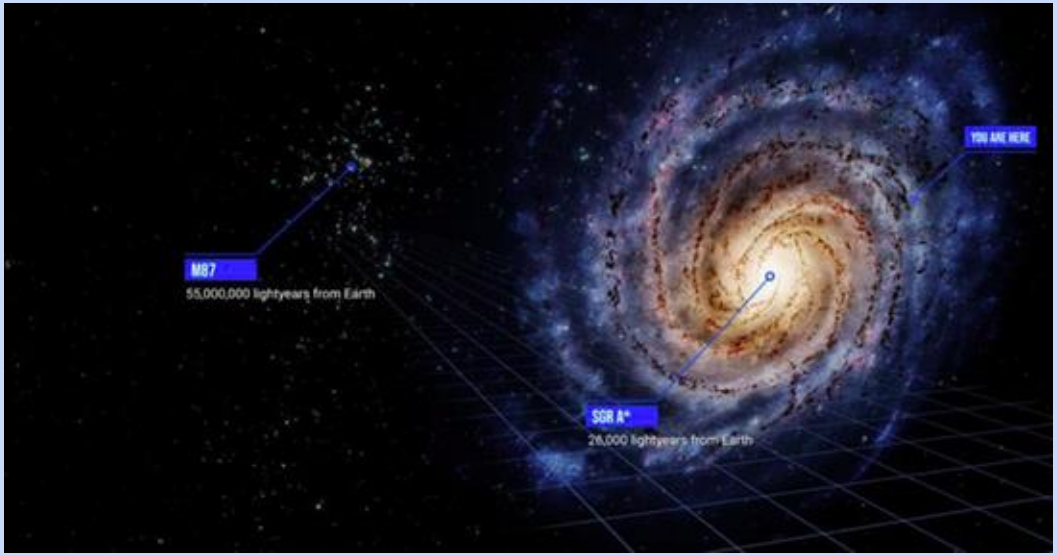
- Mergers and accretion result in black hole growth
- The problem: supermassive black holes existed early in the universe
- Expect a left over population of intermediate mass black holes (IMBHs)
- Between one hundred and one hundred thousand solar masses



Credit: NASA/JPL-Caltech

Where would IMBHs be located?

- Black hole mass scales with host galaxy mass
- Intermediate mass black holes are in dwarf galaxies
- Dwarf galaxies: gas clumps together + low surface density
- Low accretion leads to low emission
- Faint, dormant, difficult to detect



Credit: National Science Foundation/Key Li

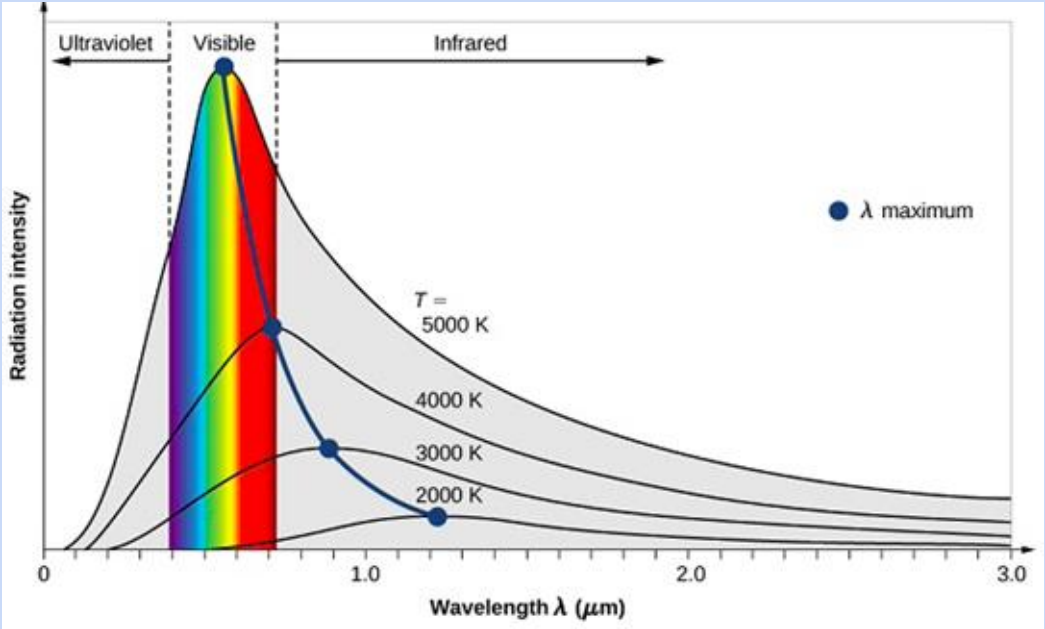
Why look at minor mergers?

- Dwarf galaxies are expected to host faint or dormant IMBHs
- Galaxy interactions can overcome these limitations
- Minor mergers: the large primary galaxy is undisturbed while small secondary galaxy undergoes intense changes
- Accretion bursts at pericentric passage: presence can be observed
- The secondary galaxy in a minor merger hosts the actively accreting intermediate mass black hole

Credit: Pearson

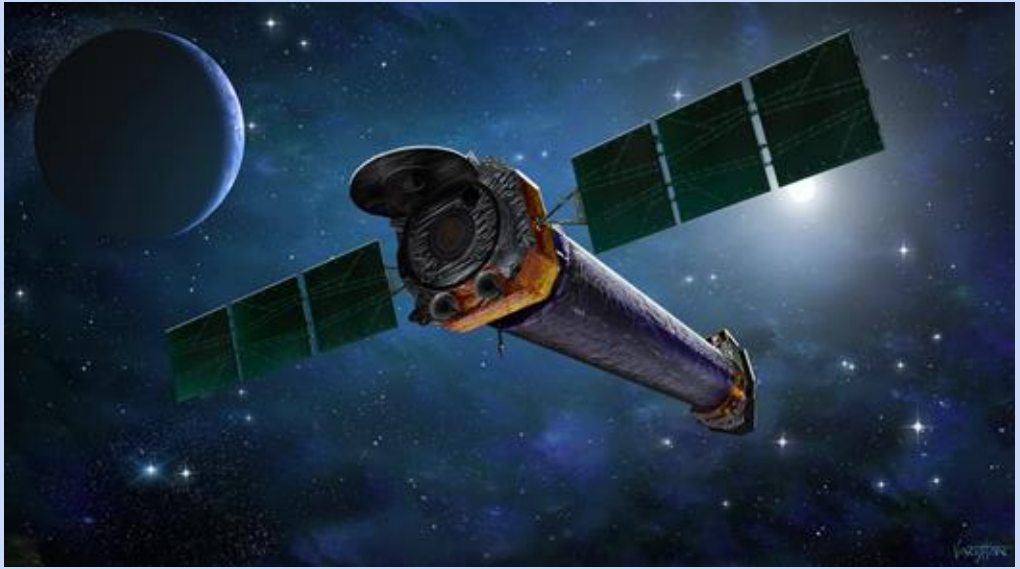
How are IMBHs detected?

- Accretion disk emits seed photons
- Pass through the corona and undergo energy up-scattering
- The observational signature produced is a hard X-ray power law spectrum
- Increased accretion rate results in the corona being: overwhelmed, cooled, and collapsed
- The observational signature is a thermal blackbody spectrum that peaks in the soft x-ray band



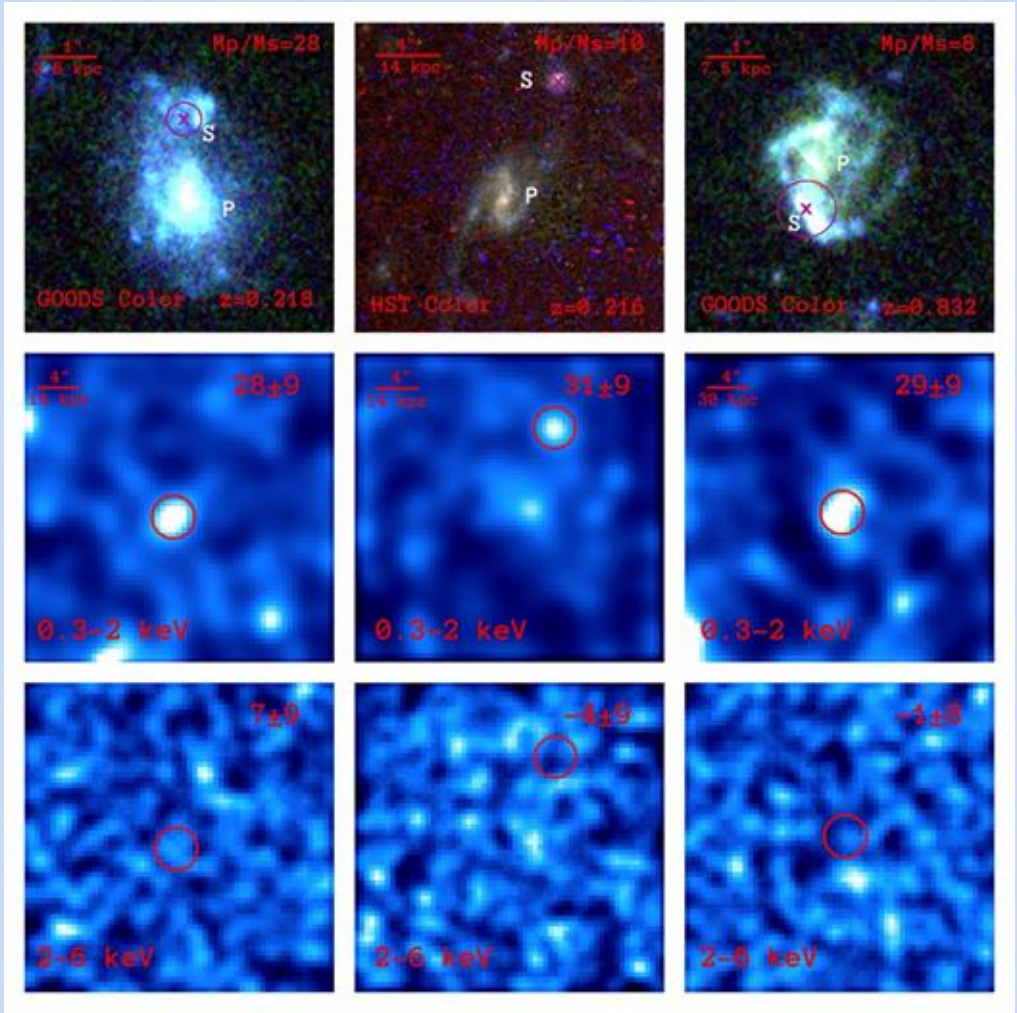
What data is being used?

- Chandra Deep Field South
- Hundreds of deep space observations
- Spans over 17 years
- Over 7 million exposure seconds
- Faint object detection
- Three galaxy interactions



Credit: NASA/CXC & J.Vaughan

Optical →



← Soft band X-rays

Hard band X-rays →

Courtesy of M. Mićić