

Active Galaxies: where matter meets cosmic monsters



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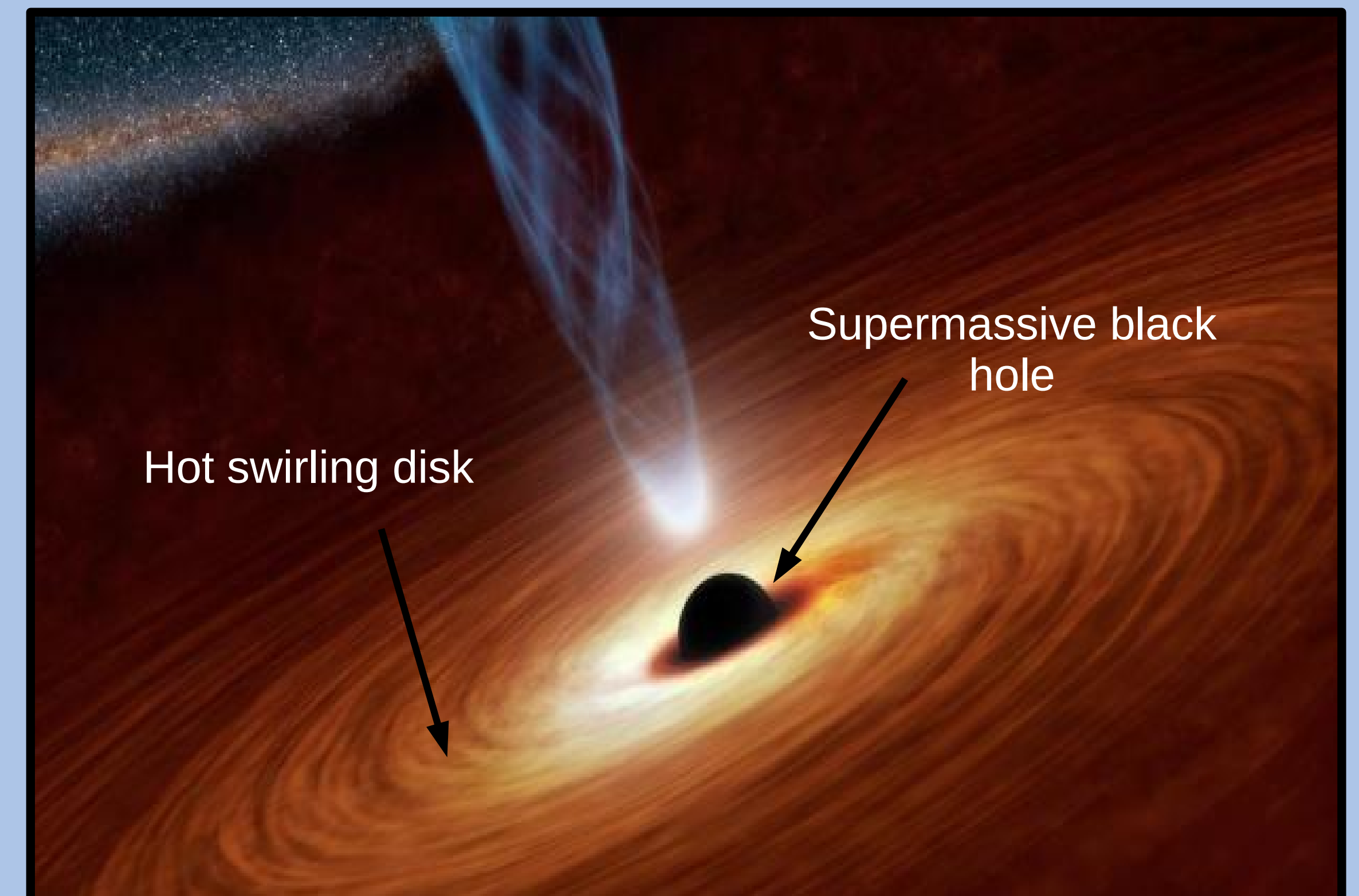
Active Galaxies



- Active galaxies are different from normal galaxies.
- They produce humongous amounts of energy, and in some cases, even launch powerful jets to incredible distances.
- They contain a very bright center, known as an active galactic nucleus (AGN) which emits powerful radiation.

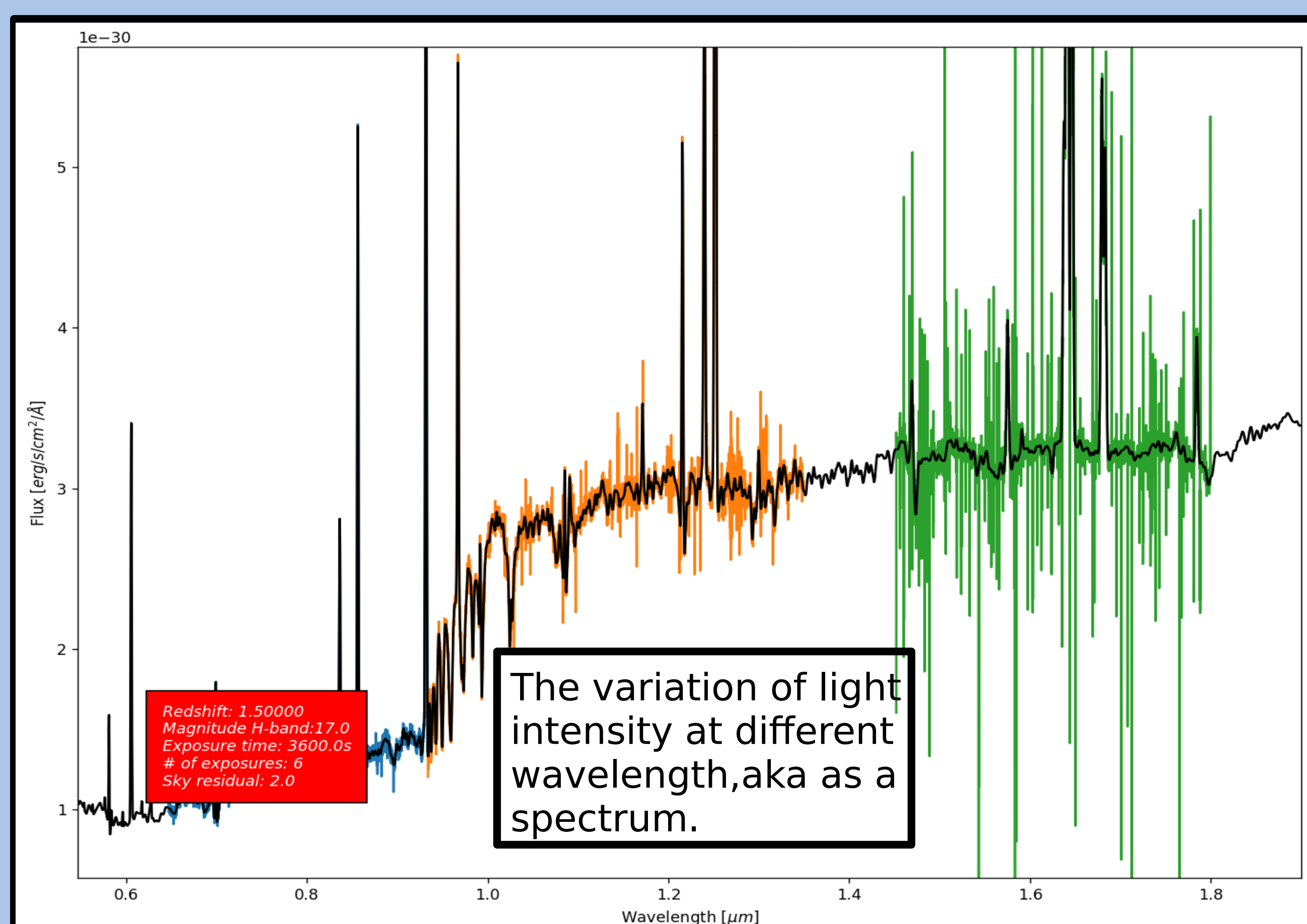
What causes such powerful radiation to be emitted?

Meet the monsters



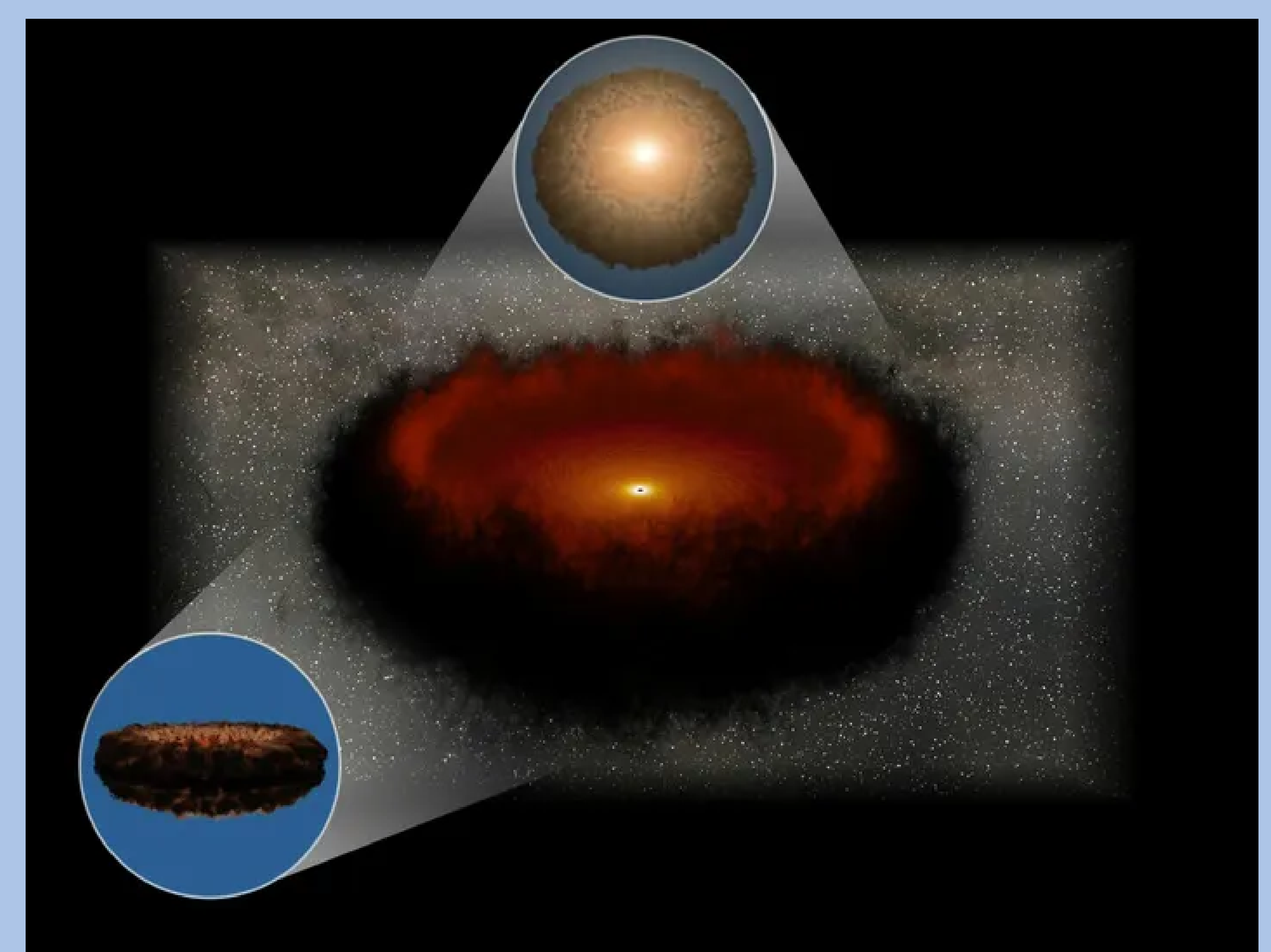
- Most galaxies contain a supermassive black hole (SMBH) at their centers.
- SMBHs are much heavier than stellar black holes. They weigh over a million suns.
- A SMBH pulls its surrounding matter in the form of a swirling disk, with different parts of the disk moving at different speeds.
- The speed difference causes friction among the material, which heats the disk to very high temperatures, almost twenty times hotter than the surface of the Sun.
- As a result, it emits high amounts of electromagnetic radiation.

Seeing the light



- We have generated a large set of simulated VLT/MOONS spectra of AGNs.
- MOONS is a next-generation spectrograph which will be installed at ESO's Very Large Telescope (VLT) in Chile.
- The simulations help us to understand how an AGN using MOONS will look like.
- This helps us to plan the future observations: e.g., we will be able to decide how long MOONS should look at a specific galaxy to collect data from it with the desired maximum quality.
- The Institute of Astrophysics and Space Sciences (IA) is co-leading the development of MOONS.
- At IA, we are also investigating the effect of AGN in estimating the properties of galaxies.
- In order to do so, we are using the publicly available FADO population synthesis code, developed by IA researchers (Gomes & Papaderos 2017).

Same object viewed at different angles?



- There are many varieties of active galaxies.
- Studies have shown that the SMBH and the swirling disk are surrounded by a doughnut of dust.
- So, their orientation relative to the Earth determines which part of the object we see:
 - If we see them face-on, we see the bright center and receive the strong radiation emitted by the hot swirling disk.
 - If we see them from the side, the dust doughnut completely hides this luminous region from our view.
- Astronomers realized that the diversity of active galaxies is perhaps a result of viewing the same objects but at different angles. This idea is known as the unified model of active galaxies.

How do these objects look like when seen through a telescope?

Acknowledgments

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