Key points from Lecture 14 of ASTR 350

1. Observations of the universe in radio wavelengths started in the 1930s but were largely ignored until the 1950s.
2. Because radio waves are much longer (millimeters or longer) than optical light (half a micron is typical), radio telescopes must be built differently than optical telescopes. If you use a single dish to detect radio waves, your angular localization is poor. In contrast, if you use multiple radio telescopes separated over the Earth, your angular localization can be better than in any other wavelength.
3. In the 1950s various pointlike radio sources were discovered. In 1963, Maarten Schmidt at Caltech realized that despite being relatively bright, these sources were extremely far away. The first "quasar" (quasi-stellar [i.e., pointlike] radio source) was 3C273, i.e., the 273rd object in the third Cambridge catalog of radio sources.
4. Thus quasars have high luminosities. Moreover, because they vary rapidly, they must be small (size of our Solar System or smaller).
5. These remarkable properties (commonly $100\times$ brighter than our Milky Way while fitting into a volume smaller than the Solar System!) are explained by having quasars and similar objects being powered by accreting supermassive black holes, with masses $10^6 - 10^{10}\ M_\odot$!
6. If the flux from the radiation is strong enough, it can push matter away from the black hole.