

Extragalactic Astrophysics: Question Sheet 7

1. Observations show that active galactic nuclei were most active at times of 3 billion years after the big bang. Then they had a space density of $\sim 350 \text{ Gpc}^{-3}$. Estimate the total energy input into the universe per cm^3 and second by AGN. Compare this value with the energy input by stars assuming that there are 10^{10} stars per galaxy and 1 galaxy per Mpc^3 .

2. What is the Eddington luminosity and the Schwarzschild radius of the black hole at the centre of the Milky Way? ($M_{\text{BH}} \sim 3 \times 10^6 M_{\odot}$) If the black hole was shining with the Eddington luminosity, what would be its brightness here on Earth, given that its distance is 8 kpc?

3. Use the energy input of AGN in Problem 1 to estimate the total energy density of photons produced by AGN in the Universe (assuming a typical lifetime of AGN of 100 Million years). Compare this with the energy density of the cosmic microwave background which has a temperature of 3 K.

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