

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Cosmology, 1st Homework Assignment, Spring 1401

1. Calculate the Hubble flow at the physical distance $d \approx 765kpc$ away from us. This is the distance that the Andromeda Galaxy is located. Knowing that the measured redshift of the Andromeda galaxy is $z \approx -0.001$, find its peculiar radial velocity relative to us. ($H_0 \approx 70km/s/Mpc$).
2. Draw the log-log graph of temperature vs. time in the universe using the data in Table 1.2 of Baumann's book.
3. Derive the Christoffel symbols, the Ricci tensor and the Ricci scalar of FLRW metric with spatial curvature k .
4. Combine the Friedmann and the Raychaudhuri equations to derive the continuity equation.
5. Expand $H_0(t_0 - t)$ as a function of redshift z up to the third order, using the deceleration parameter q_0 and the jerk J_0 in the coefficients.
6. Find a relation for the angular diameter distance d_A in a spatially flat FLRW model up to the second order of the redshift z (for very low redshift $z \ll 1$), using the Hubble constant H_0 and the deceleration parameter q_0 in the coefficients.

Good Luck
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