

Homework problems #10

1. Show that the “retarded-potential”

$$h_{\mu\nu}(t, \vec{x}) = 4\pi \int d^3x' \frac{S_{\mu\nu}(t - |\vec{x} - \vec{x}'|, \vec{x}')}{|\vec{x} - \vec{x}'|}$$

that is a solution of the graviton equation of motion in the harmonic gauge

$$\square h_{\mu\nu} = -16\pi G(T_{\mu\nu} - \frac{1}{2}\eta_{\mu\nu}T^\alpha_\alpha)$$

indeed satisfies the harmonic gauge condition.

2. Expand the energy-momentum “tensor” of gravitational field

$$t_{\mu\nu} \equiv \frac{1}{8\pi G} \left[R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R^\lambda_\lambda - R^{(1)}_{\mu\nu} + \frac{1}{2}g_{\mu\nu}R^{(1)\lambda}_\lambda \right]$$

up to the second order in powers of the graviton field $h_{\mu\nu}(x)$.