unique decomposition: $\pi^{ij} = \tilde{\pi}^{ij} + \pi^{ij}_{\rm TT}$

$$\tilde{\pi}^{ij} = \partial_i \pi^j + \partial_j \pi^i - \frac{2}{3}\delta_{ij}\partial_k \pi^k$$

$\pi^{ij}_{\rm TT} c^3/16\pi G$: canonical conjugate to $h^{\rm TT}_{ij}$

ADM Hamiltonian

$$H\left[x^i_a, p_{ai}, h^{\rm TT}_{ij}, \pi^{ij}_{\rm TT}\right] = -\frac{c^4}{16\pi G}\int d^3x\, \Delta\phi\left[x^i_a, p_{ai}, h^{\rm TT}_{ij}, \pi^{ij}_{\rm TT}\right]$$

Routh functional

$$R\left[x^i_a, p_{ai}, h^{\rm TT}_{ij}, \partial_t h^{\rm TT}_{ij}\right] = H - \frac{c^3}{16\pi G}\int d^3x\, \pi^{ij}_{\rm TT}\partial_t h^{\rm TT}_{ij}$$

$$\frac{\delta \int R(t')dt'}{\delta h^{\rm TT}_{ij}(x^k, t)} = 0, \quad \dot{p}_{ai} = -\frac{\partial R}{\partial x^i_a}, \quad \dot{x}^i_a = \frac{\partial R}{\partial p_{ai}}$$