

Homework 6 - Newtonian perspective

Q6.1. For a particle with spacetime velocity $u^{\mathbf{a}}$ experiencing a spacetime force $f_{\mathbf{a}}$, show that

$$f_{\mathbf{a}}u^{\mathbf{a}} = 0 \quad (\text{Q6.1.1})$$

and interpret this equation from a Newtonian perspective.

Q6.2. In the space-time decomposition of the metric, Eq. (2.2.9), set

$$A = 1 + 2\phi \quad (\text{Q6.2.1})$$

and use the Newtonian approximation

$$\phi, B_{\mathbf{a}}v^{\mathbf{a}}, h_{\mathbf{ab}}v^{\mathbf{a}}v^{\mathbf{b}} \ll 1 \quad (\text{Q6.2.2})$$

- (a) Reexpress the relativistic uncharged particle action in space-time decomposed form and interpret the leading terms in your action.
- (b) Calculate the Euler-Lagrange equation for the leading terms in your action and interpret the resulting equation.
- (c) Reexpress the spacetime momentum in space-time decomposed form and interpret the leading terms.