Homework No. 09 (Spring 2018)

PHYS 510: Classical Mechanics

Due date: Thursday, 2018 May 3, 4.30pm

1. (**20 points.**) The path of a relativistic particle moving along a straight line with constant (proper) acceleration α is described by the equation of a hyperbola

$$x^2 - c^2t^2 = x_0^2, \qquad x_0 = \frac{c^2}{\alpha}. \tag{1}$$

This is the motion of a particle 'dropped' from $x = x_0$ at $t = 0$ in region of constant (proper) acceleration.

(a) Will a photon dispatched to 'chase' this particle at $t = 0$ from $x = 0$ ever catch up with it? If yes, when and where does it catch up?

(b) Will a photon dispatched to 'chase' this particle at $t = 0$ from $0 < x < x_0$ ever catch up with it? If yes, when and where does it catch up?

(c) Will a photon dispatched to 'chase' this particle, at $t = 0$ from $x < 0$ ever catch up with it? If yes, when and where does it catch up?

What are the implications for the observable part of our universe from this analysis?