

电动力学作业题

20240403

答题不要求用英语，但应尽量做到逻辑缜密、清晰可读。提交作业不必通过BB网，截止时间请助教决定。

1. A particle has 4-velocity U^μ in the direction of the vector $A^\mu = (3, 0, 0, 1)$ in Cartesian coordinates. Is it a massive or a massless particle? Write down the components of U^μ in these coordinates.
2. A massive particle has 4-velocity $U^\mu = (2, A, B, C)$ in units $c = 1$, where A , B , and C are unknown constants. Determine the possible values of its spatial components by knowing that (1) U^μ is orthogonal to a 4-vector $A^\mu = (0, 1, 1, 1)$ and (2) $U^\mu B_\mu = 3$, where the 4-vector $B^\mu = (0, 0, 0, 3)$.
3. A massive particle has 3-velocity

$$\mathbf{u} = \frac{u_0}{1 + (t/t_0)} \mathbf{e}_1 \quad (1)$$

in inertial frame Σ of reference, where u_0 and t_0 are two positive constants, \mathbf{e}_1 is the basis vector of Cartesian coordinate x^1 -axis. What is the proper time τ of this particle as a function of t ? What is its 4-velocity?