

Relativistic Astrophysics. 2009. Course Work 2

Q1.

Formulate the equivalence principle and explain what is the difference in interpretation of this principle in Newtonian theory and in General relativity.

Q2.

A rocket moves very far from any gravitating bodies with acceleration $5g$. Using the equivalence principle, show, that in first order with respect to h/R the redshift of a photon emitted at the bottom of the rocket and detected at its top is the same as if the rocket were at rest on the surface of a planet with mass M and radius R related by the following relationship: $MR_{\oplus}^2 = 5M_{\oplus}R^2$. Calculate the redshift if the height of the rocket is $169m$. (You can assume that the diameter of the Earth is $13\,000\text{ km}$ and its gravitational radius is 1 cm).

Q3.

Formulate the covariance principle and explain the relationship between this principle and the principle of equivalence.