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Quantum Fields in Curved Spacetime

Examples VIII

To hand in Monday 8th December in the examples class

1. **Rindler space**

Consider Rindler space with the metric given by

$$ds^2 = (1 + aX)^2 dt^2 - dX^2 \,. \tag{1}$$

Determine the form of **geodesics** for both massive and massless particles. Verify that $K_\mu = 1, 0, 0, 0$ is a **Killing vector** field that satisfies $\mathcal{L}_K g_{\mu\nu} = 0$, i.e. $\nabla_{(\mu} K_{\nu)} = 0$ and generates an isometry of the metric. Find the **Killing horizon** associated with this Killing vector, i.e. the surface on which the Killing vector is null (lightlike). Calculate the **redshift** $z = K_\nu K^\nu$ and show that it vanishes on the horizon.

(5 pts)

2. **Unruh temperature**

A glass of water is moving with constant acceleration. Determine the smallest acceleration that would make the water boil at 100°C due to the Unruh effect. Use SI units.

(5 pts)