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Quantum Fields in Curved Spacetime

Examples X

To hand in Wednesday 7th January in the lecture

1. **Surface Gravity**

Calculate the acceleration $a_\mu = U^\rho \nabla_\rho U_\mu$ of a static observer near the horizon of the Schwarzschild black hole, where U^μ is the four-velocity. What is the magnitude of the acceleration $a = \sqrt{a_\mu a^\mu}$?

Show that for a Schwarzschild black hole the surface gravity $\kappa = (4GM)^{-1}$ is the magnitude of acceleration of a static test particle near the horizon, as measured by a static observer at infinity.

(5 pts)

2. **Conformal Diagram**

Draw a conformal diagram of $1+1$ dimensional Minkowski spacetime. In particular explain the different kinds of infinities occuring in the conformal diagram. How does the conformal diagram of $3+1$ dimensional Minkowski spacetime look like?

(5 pts)