

Quantum Gravity Spring 2015

Problem Set 1

Due: Tuesday, Feb 3.

Reading: Read lecture notes 1, 2 (and 3 when it appears online). Also read section 9.5 (Unruh radiation) of Carroll's GR book *Spacetime and Geometry*.

1. Lecture note 2, exercise "Thermodynamics of 3d black holes"
2. Lecture note 2, exercise "Black hole collision"
3. Lecture note 2, exercise "Perturbative 2nd law"
4. $\zeta_{(\eta)} = \partial_\eta$ is an obvious Killing vector of Rindler space, since the metric is independent of η . By explicitly transforming this vector to Minkowski coordinates, show that it is a Lorentz boost.¹
5. (*optional) Lecture note 2, exercise "Thermodynamics of rotating black holes"
6. (*optional) Lecture note 3, exercise "Kerr periodicity" (not yet online but will be by the end of the week!)

¹Reminder: The notation $\zeta = \partial_\eta$ means, in components, $\zeta^\mu \partial_\mu = \partial_\eta$, *i.e.*, $\zeta = \hat{\eta}$.