Torsten Bringmann (torsten.bringmann@fys.uio.no)
http://www.uio.no/studier/emner/matnat/fys/FYS4160/v17/

Lecture spring 2017:

General Relativity

Problem sheet 8

$\rightsquigarrow$ These problems are scheduled for discussion on **Thursday, 23 March 2017**.

Problem 28

The Lagrangian for a scalar field ϕ is given by

$$\mathcal{L}/\sqrt{-g} = -\frac{1}{2}\left(\nabla^\mu\phi\right)\left(\nabla_\mu\phi\right) - V(\phi)\,.$$

Calculate the stress-energy tensor, as it would appear on the right-hand side of Einstein's equations, and show that it is covariantly conserved! Compare this result to the one that you obtained in Problem 26!

Problem 29

In the lecture on Friday, we will briefly go through the (Newtonian) Kepler problem. Fill in the gaps by deriving

a) the orbit equation, $r(\phi) = r_0/(1 - \epsilon\cos\phi)$

b) the conditions on the eccentricity ϵ, and equivalently the energy E, to give hyperbolic, parabolic, elliptic or circular orbits.