

# Oblig3 FYS9130

Deadline: Tuesday 21/9 at 12.15 (beginning of class)

## 1. Maximal symmetric spaces

For a maximally symmetric space we can write

$$R = \text{constant} \quad (1)$$

$$R_{\mu\nu} = ag_{\mu\nu} \quad (2)$$

$$R_{\mu\nu\rho\sigma} = b(g_{\mu\rho}g_{\nu\sigma} - g_{\mu\sigma}g_{\nu\rho}) \quad (3)$$

where  $a$  and  $b$  are constants. In  $n$  dimensions, find  $a$  and  $b$  given by the Ricci scalar  $R$ .

## 2. Maximal symmetric spaces in 3 spatial dimensions

Assume a maximal symmetric metric in 3 spatial dimensions:

$$ds^2 = \frac{dr^2}{1 - kr^2} + r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2 \quad (4)$$

- a) Find the non-zero Christoffel symbols
- b) Find the non-zero components of the Riemann tensor
- c) Find the non-zero components of the Ricci tensor
- d) Calculate the Ricci scalar

## 3. Maximal symmetric spaces in $n$ spatial dimensions

Assume  $n$  instead of 3 dimensions:

$$ds^2 = \frac{dr^2}{1 - kr^2} + r^2 d\Omega_n^2 \quad (5)$$

where

$$d\Omega_n^2 = d\theta_1^2 + \sin^2 \theta_1 d\theta_2^2 + \sin^2 \theta_1 \sin^2 \theta_2 d\theta_3^2 + \cdots + \sin^2 \theta_1 \cdots \sin^2 \theta_{n-2} d\theta_{n-1}^2 \quad (6)$$

How does the Ricci scalar change when we go to  $n$  dimensions?

If possible, deliver a paper copy, handwritten is ok. Otherwise, e-mail to [ingunnkw@fys.uio.no](mailto:ingunnkw@fys.uio.no)