

**Exercise sheet 10****1. Christoffel symbols and the Ricci tensor**

Find the Christoffel symbols and the Ricci tensor for the metric  $dl^2 = S(t) [B(r)dr^2 + r^2d\Omega]$ .

**2. Redshift**

Derive the redshift of a photon in the FLRW metric analogous to the redshift of a photon in the Schwarzschild metric, using the fact that homogeneity leads to the existence of three space-like Killing vector fields. [For simplicity, restrict yourself to the flat case  $k = 0$ .]

**3. New galaxies.**

As the universe expands, the horizon grows. *Estimate* the time it takes for one galaxy entering the horizon assuming the universe to be matter-dominated.