

## OBSERVATIONAL COSMOLOGY

### PROBLEM SHEET 5 - 29/06/2017

1) Peculiar velocities alter the observed redshift of a galaxy from the cosmological one. Show that, for non-relativistic peculiar velocities, the observed redshift  $z_{\text{obs}}$  and the cosmological redshift  $z_{\text{cos}}$  are related as follows:

$$1 + z_{\text{obs}} = (1 + z_{\text{cos}}) \left( 1 + \frac{v_{\parallel} - v_{\parallel, \text{o}}}{c} \right) + \mathcal{O} \left[ \left( \frac{v}{c} \right)^2 \right], \quad (1)$$

where  $c$  is the speed of light,  $v_{\parallel}$  is the component of the peculiar velocity of the galaxy along the line of sight and  $v_{\parallel, \text{o}}$  is the line of sight component of the peculiar velocity of the observer.

2) What is the the second order correction in  $\frac{v}{c}$ ?

3) Estimate the extent (in comoving Mpc) of the Fingers of God in a galaxy cluster at  $z = 0.1$  and at  $z = 1$ .