1　光度距离

设发射时刻为 t_1, 接收时刻为 t_2, 则光度距离 $L_{\rm l} = (L/4\pi l)^{1/2} = (\frac{{\rm d}E_1}{{\rm d}t_1}/4\pi(\frac{{\rm d}E_2}{{\rm d}t_2}/4\pi D^2))^{1/2} = D(({\rm d}E_1/{\rm d}E_2)({\rm d}t_2/{\rm d}t_1))^{1/2} = D((\hbar\omega_1/\hbar\omega_2)(\omega_1/\omega_2))^{1/2} = D(\omega_1/\omega_2) = D(\lambda_2/\lambda_1) = D(1+z)$.

2　角直径距离

设发射时刻为 t_1, 接收时刻为 t_2, source 坐标为 $(-x, 0, 0)$, source 边缘坐标为 $(-x, \pm\Delta y, 0)$, detector 坐标为 $(0, 0, 0)$, 则 source 边缘辐射的世界线空间投影满足 ${\rm d}x : {\rm d}y = x : \pm\Delta y$, 测得角直径 $\theta = 2\Delta y/x$, 固有线直径为 $\Delta = 2\Delta y$, 角直径距离 $D_{\rm a} = \Delta/\theta = x$, 物理距离 $D = (a(t_2)/a(t_1))x = (1+z)x$, $D_{\rm a} = D/(1+z)$.

3　自行距离

设发射时刻为 t_1, 接收时刻为 t_2, 则自行距离 $D_{\rm p} = v/\mu = ((v{\rm d}t_1)/(\mu{\rm d}t_2))({\rm d}t_2/{\rm d}t_1) = (\Delta/\theta)({\rm d}t_2/{\rm d}t_1) = D_{\rm a}({\rm d}t_2/{\rm d}t_1) = D_{\rm a}(\omega_1/\omega_2) = D_{\rm a}(\lambda_2/\lambda_1) = D_{\rm a}(1+z) = D$.