Let θ_{12} be the angular distance between $P_1 = (r_1, \theta_1, \phi_1)$ and $P_2 = (r_2, \theta_2, \phi_2)$. Then

$$\cos\theta_{12} = \cos\theta_1 \cos\theta_2 + \sin\theta_1 \sin\theta_2 \cos(\theta_1 - \theta_2)$$

Also

$$\cos\theta_{12} = \frac{r_1^2 + r_2^2 - r_{12}^2}{2 r_1 r_2}$$

where

$$r_{12}^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2$$

and

$$x_1 = r_1 \sin\theta_1 \cos\phi_1$$
$$y_1 = r_1 \sin\theta_1 \sin\phi_1$$
$$z_1 = r_1 \cos\theta_1$$

$$x_2 = r_2 \sin\theta_2 \cos\phi_2$$
$$y_2 = r_2 \sin\theta_2 \sin\phi_2$$
$$z_2 = r_2 \cos\theta_2$$