Distances and Angular Sizes

We may rearrange the relation that appeared in Lecture 1 between apparent magnitude \(m\) and absolute magnitude \(M\) at some wavelength (or in some wavelength band), and distance \(d\), as follows:

\[ m - M = 5 \log \left( \frac{d}{10 \text{ pc}} \right) \]

The quantity \((m - M)\) is called the distance modulus. Some databases include \((m - M)\), or \(d\), or in some cases (e.g., NED) \((m - M)\) and \(d\).
The relationship between distance $d$, angular separation on the sky, $\vartheta$, and physical separation $r$

in the small angle approximation ($r \ll d$) is simply $\vartheta = r/d$, for $\vartheta$ in radians, and $r$ and $d$ in identical units. Since 1 radian = 57.296 degrees = 3,437.8 arcminutes (= 206,265 arcseconds),

$$r = \vartheta d / 3437.8,$$

where $\vartheta$ is measured in arcminutes. On extragalactic scales, $d$ is often expressed in Megaparsecs (Mpc); 1 Mpc = $10^6$ pc.