The “Rotation Curves” of Galaxies

Simple example - moon’s orbit around Earth

\[ mv^2/r = GMm/r^2 \]
\[ M = rv^2/G \]

Could measure mass M of Earth by measuring \( r \) and \( v \) of moon

Use the same idea to measure mass M of a galaxy by measuring \( r \) and \( v \) of star near edge

Measure \( v \) by redshift

Result from many Galaxies: \( M \gg \) visible mass !!!