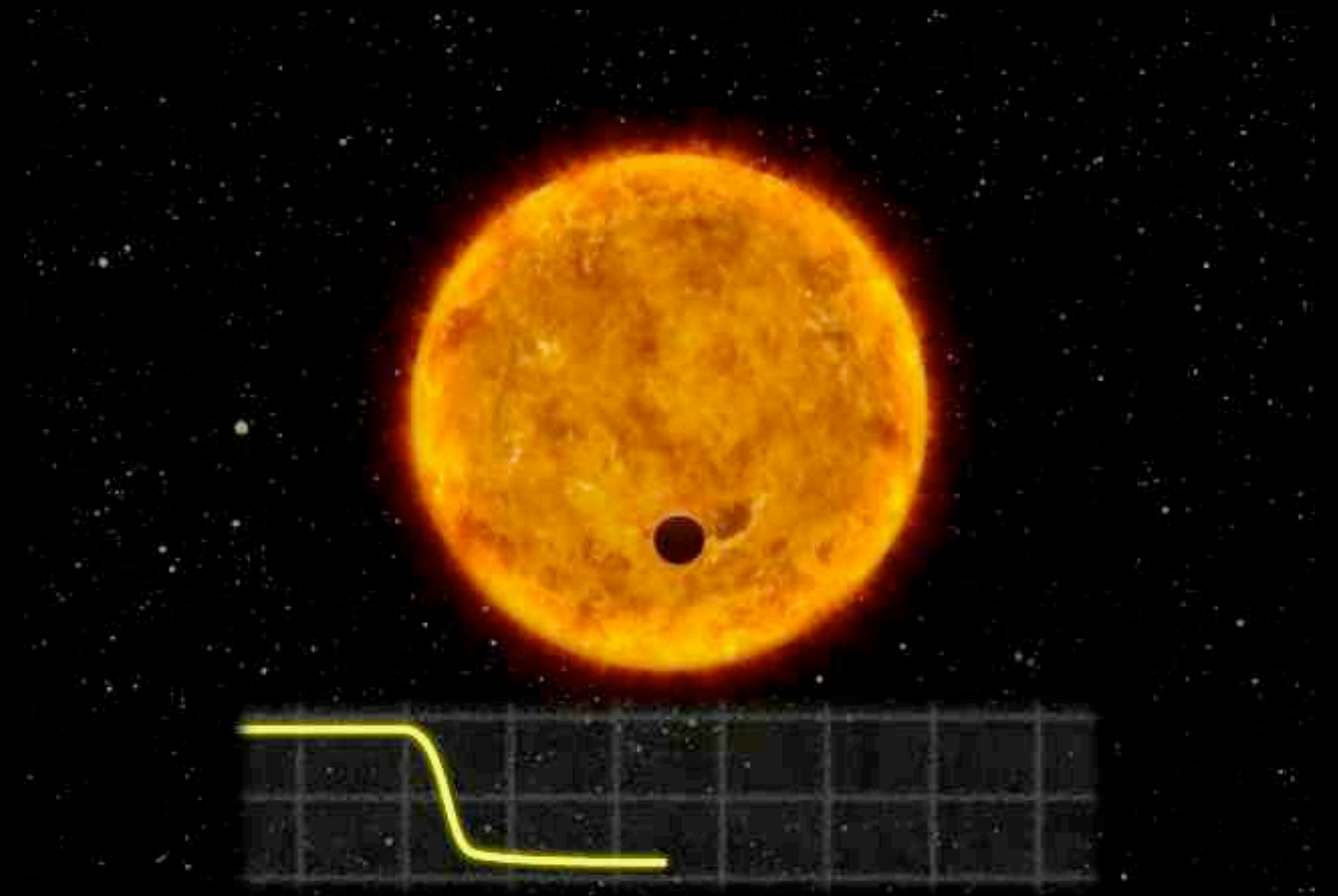
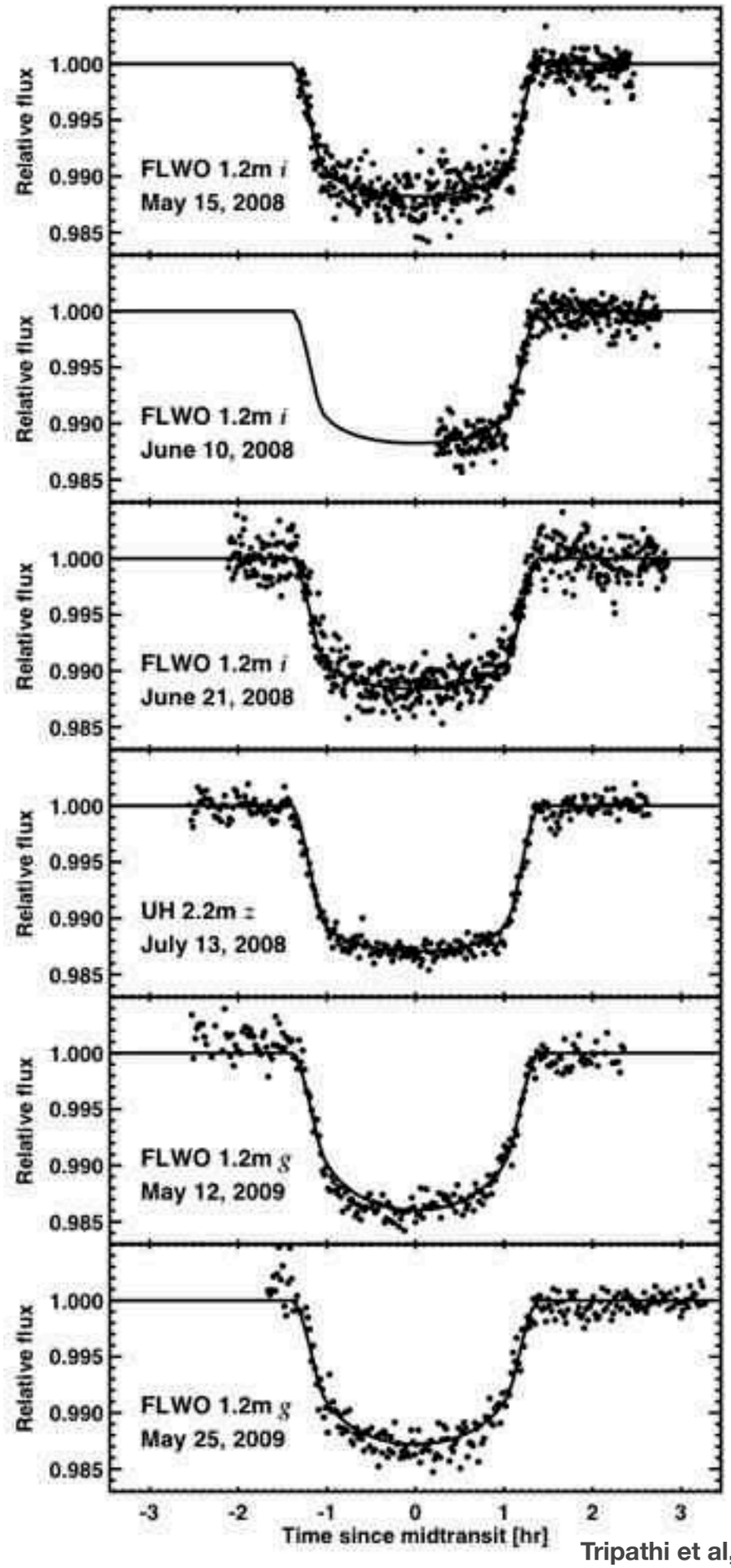
These slides were used for physics lectures at Animo South Los Angeles High School about how Newton's Law of Gravitation can be used to study planets outside of our Solar System, as well as dark matter.

-A. Tripathi, May 2011

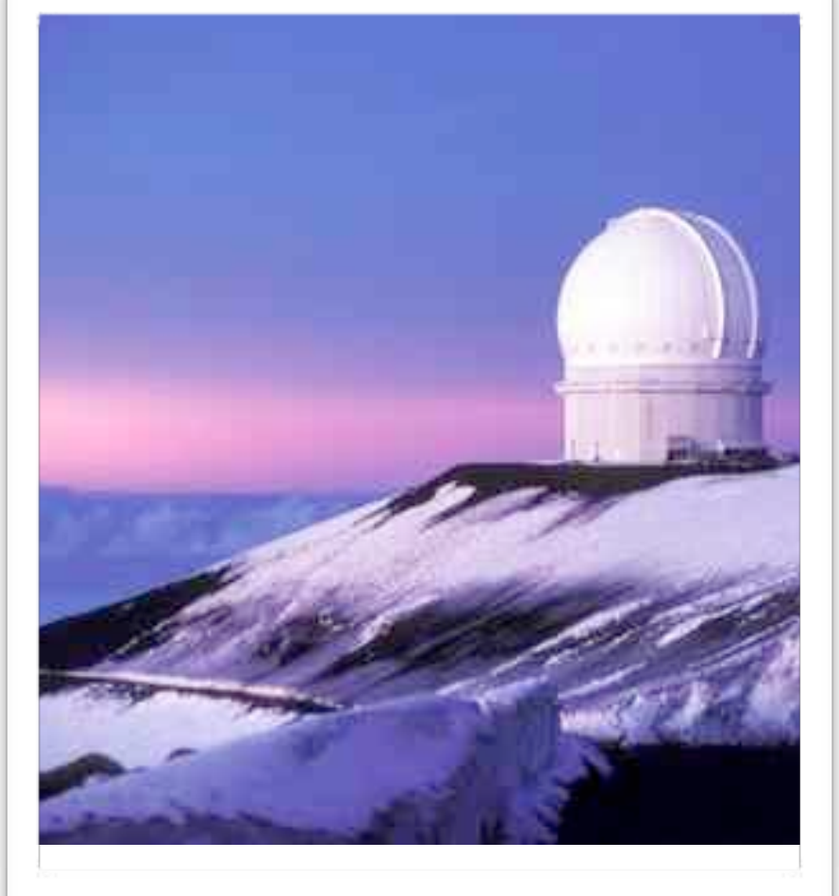


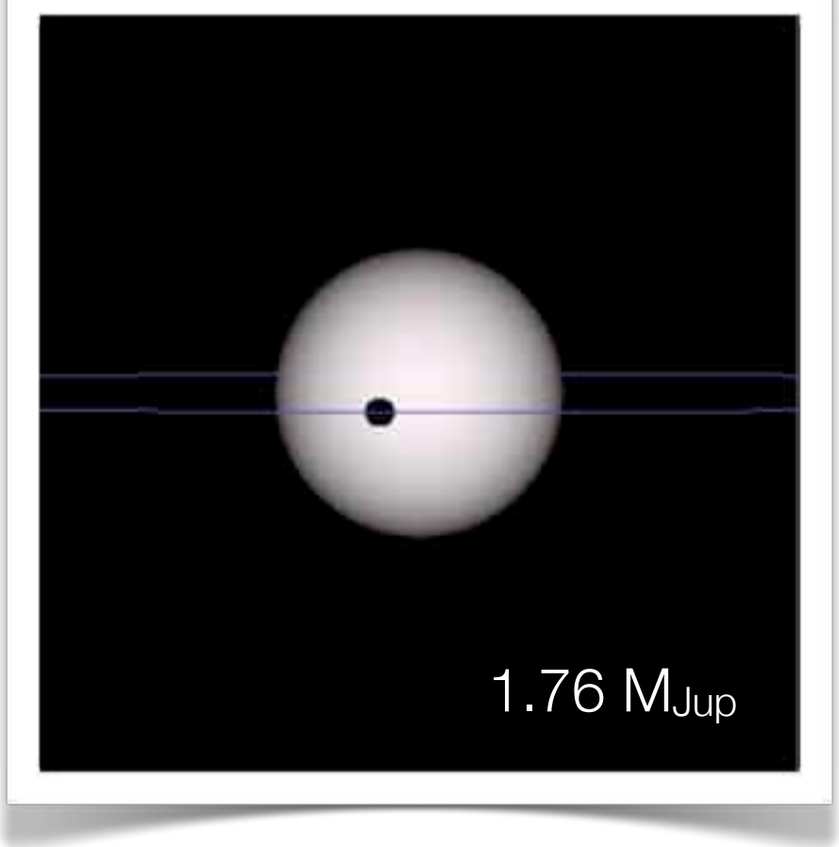
[Movie about planet transits]

NASA, ESA & G. Bacon

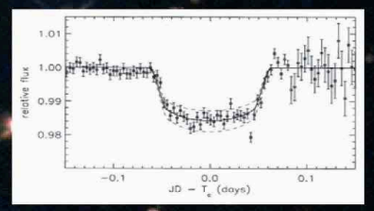


Tripathi et al, 2010

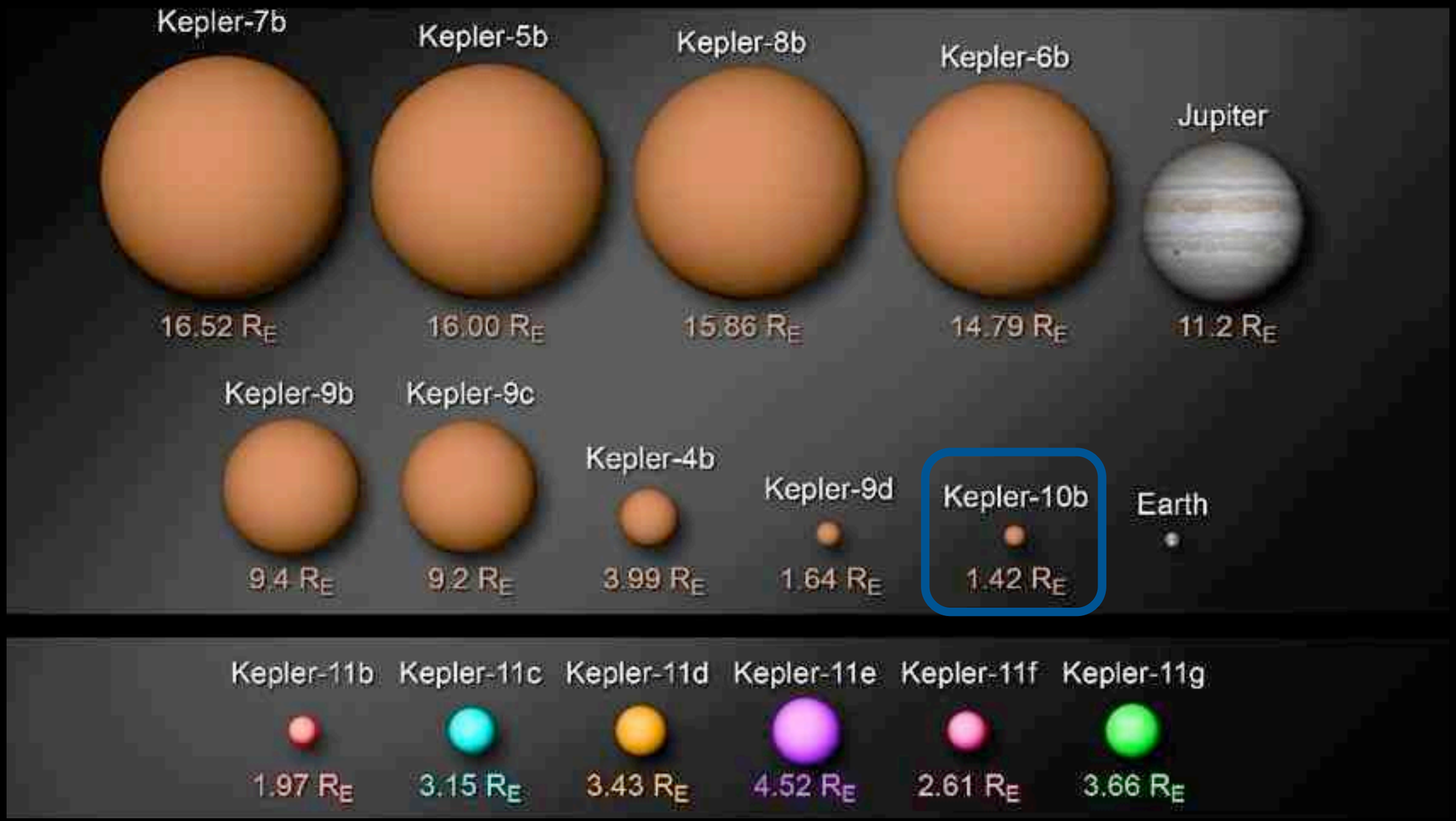




KEPLER *the Search for Extra-solar Planets*



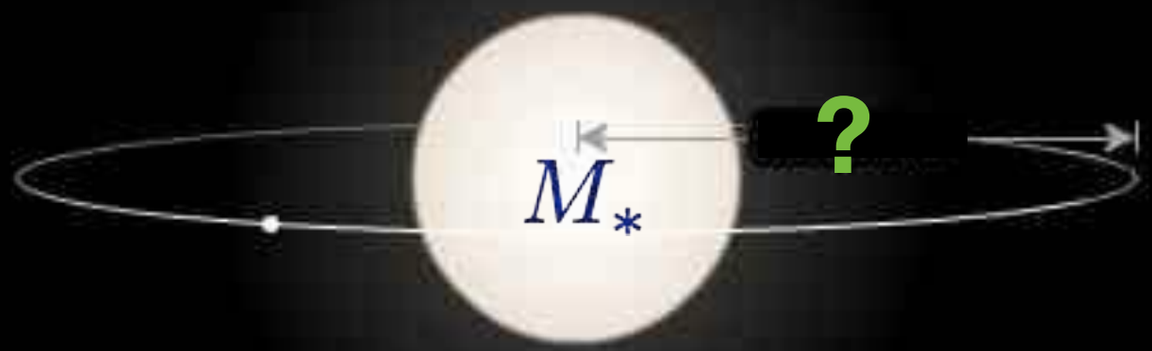
NASA, ESA



Kepler Science Team

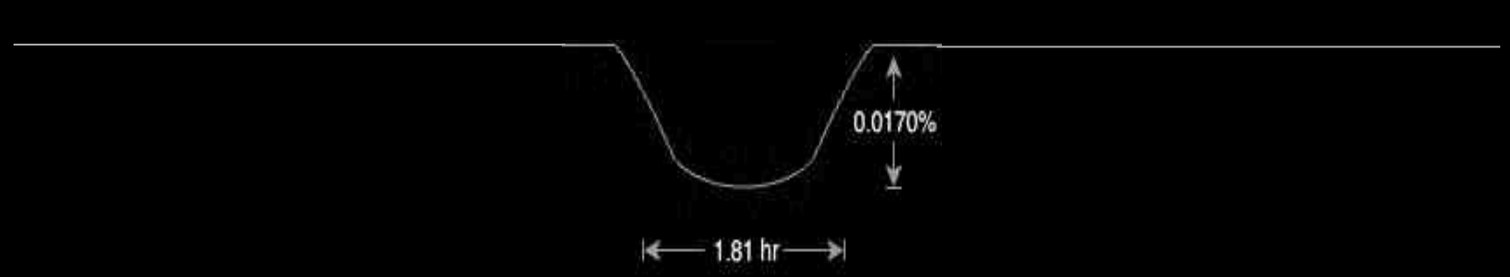
Kepler 10b

How close is the planet to the star?



Give your answer in AU. 1AU = 1.496 x 10^{11} m

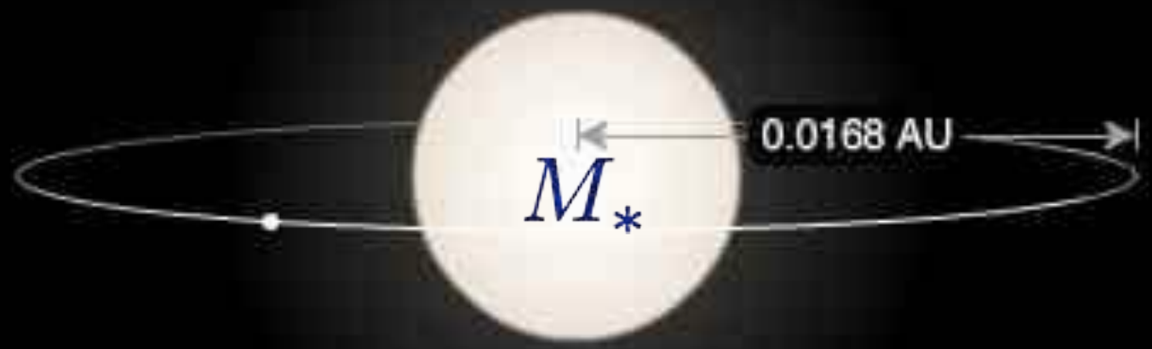
Useful information



$$M_* = 1.79 \times 10^{30}\text{kg}$$

$$T = 20.1 \text{ hr}$$

Kepler 10b

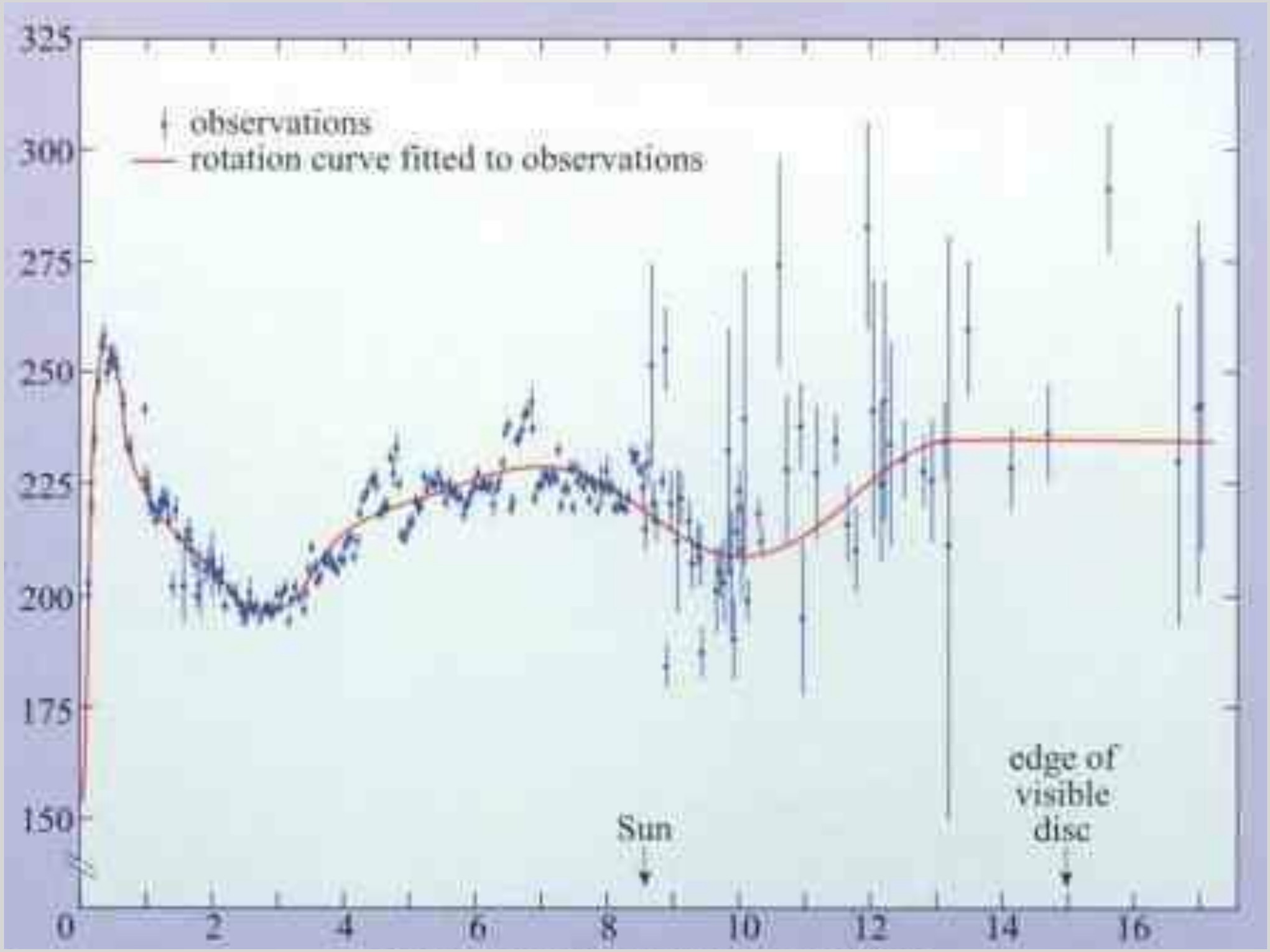


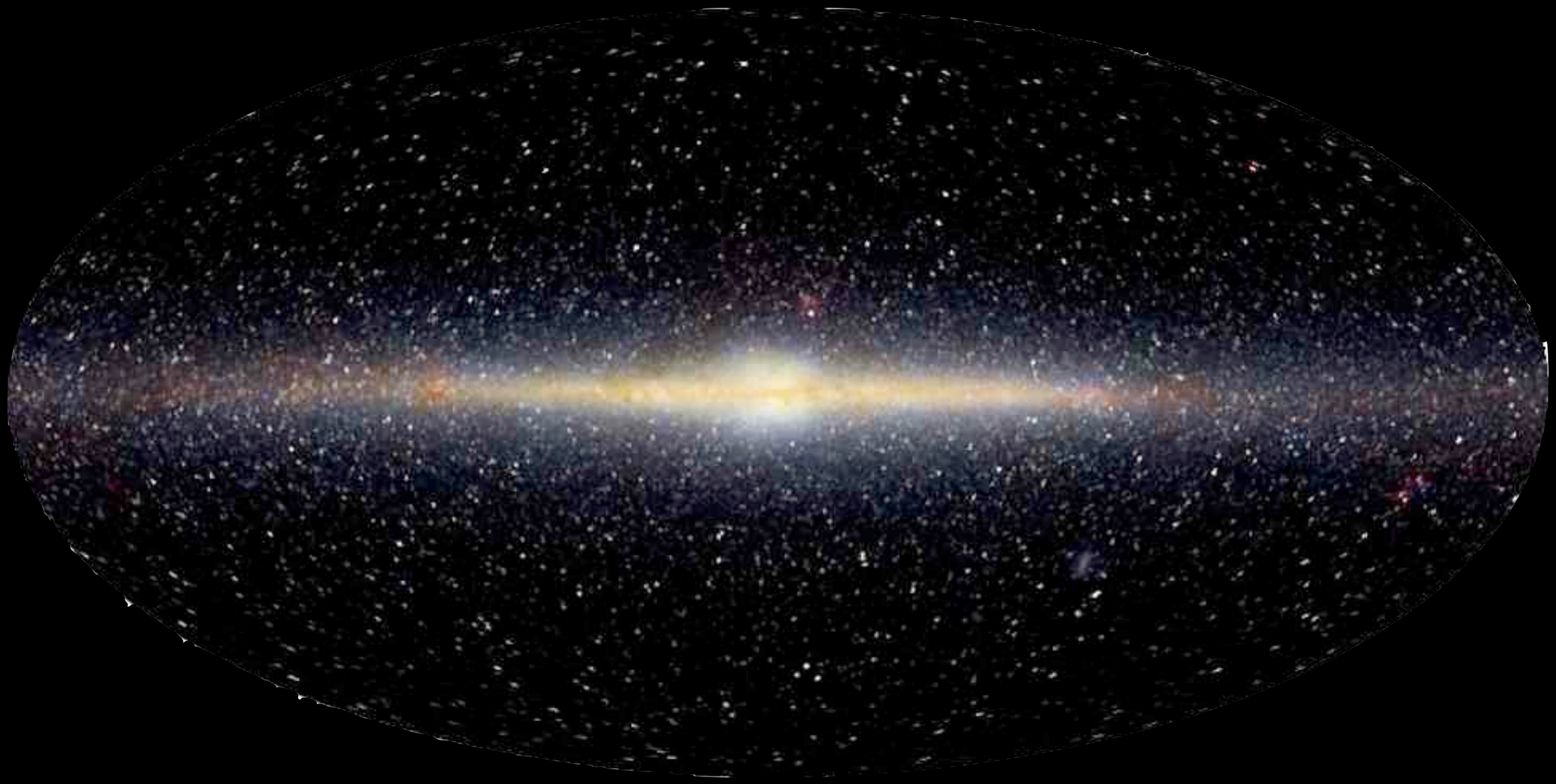
Calculation

$$
\begin{aligned}
M &= \frac{4\pi^2 r^3}{T^2 G} \\
r^3 &= \frac{MT^2G}{4\pi^2} \\
r &= \left(\frac{MT^2G}{4\pi^2}\right)^{1/3} = \left(\frac{1.79\times10^{30}\ \text{kg}\cdot\left(20.1\ \text{hr}\cdot\frac{3600\ \text{s}}{1\ \text{hr}}\right)^2\cdot 6.67\times10^{11}\ \frac{\text{m}^3}{\text{kgs}^2}}{4\pi^2}\right)^{1/3} \\
&= 2.51\times10^{9}\ \text{m}\cdot\frac{1\text{AU}}{1.496\times10^{11}\text{m}} \\
&= 0.0168\ \text{AU}\ \checkmark
\end{aligned}
$$

Too close for life!

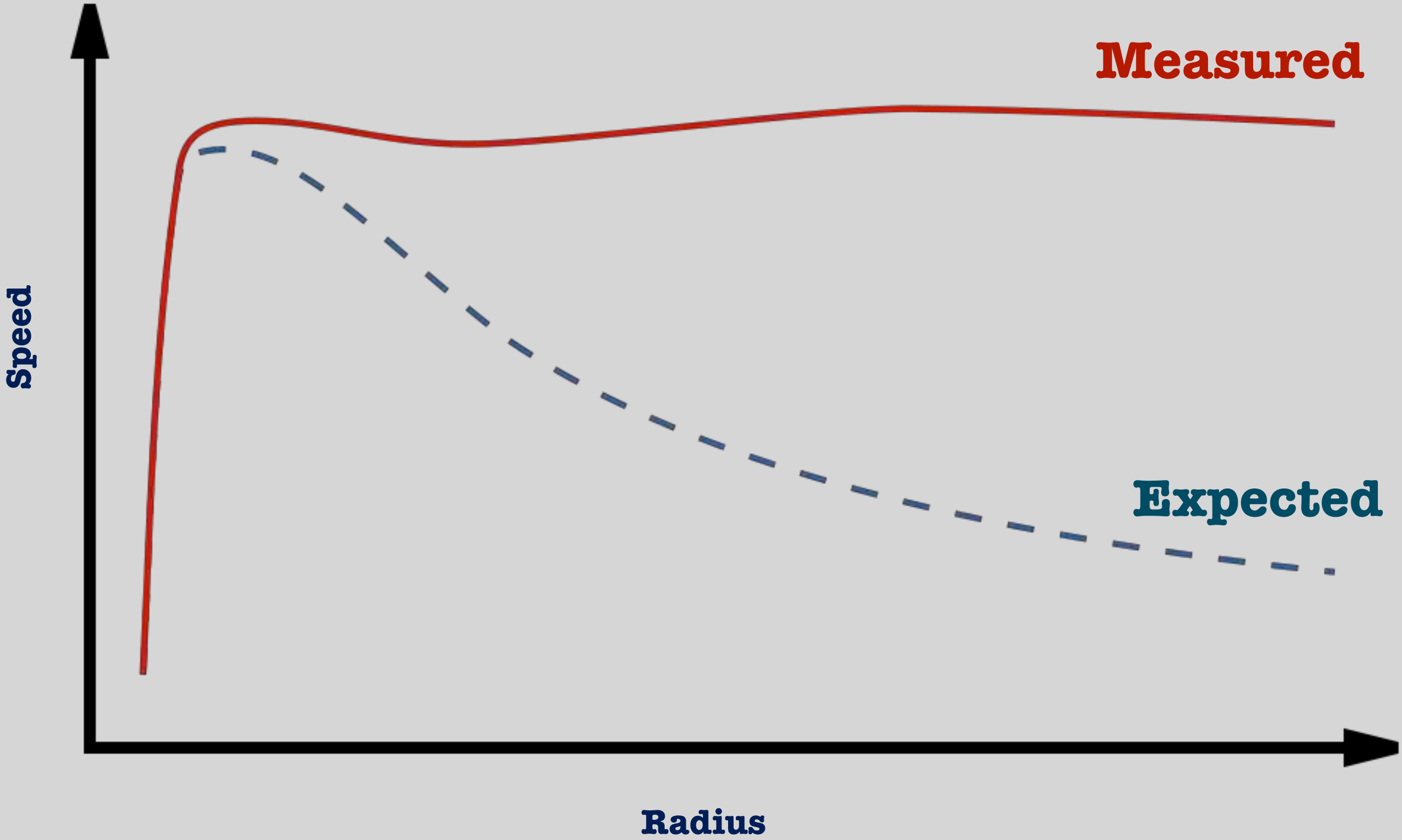
Milky Way Rotation Curve





Light decreases further out!

Rotation Curves



Flickr - tylerdurden

Bullet Cluster

NASA/STScI; Magellan/U.Arizona/D.Clowe et al.

Visible Matter

NASA/CXC/CfA/M.Markevitch et al.

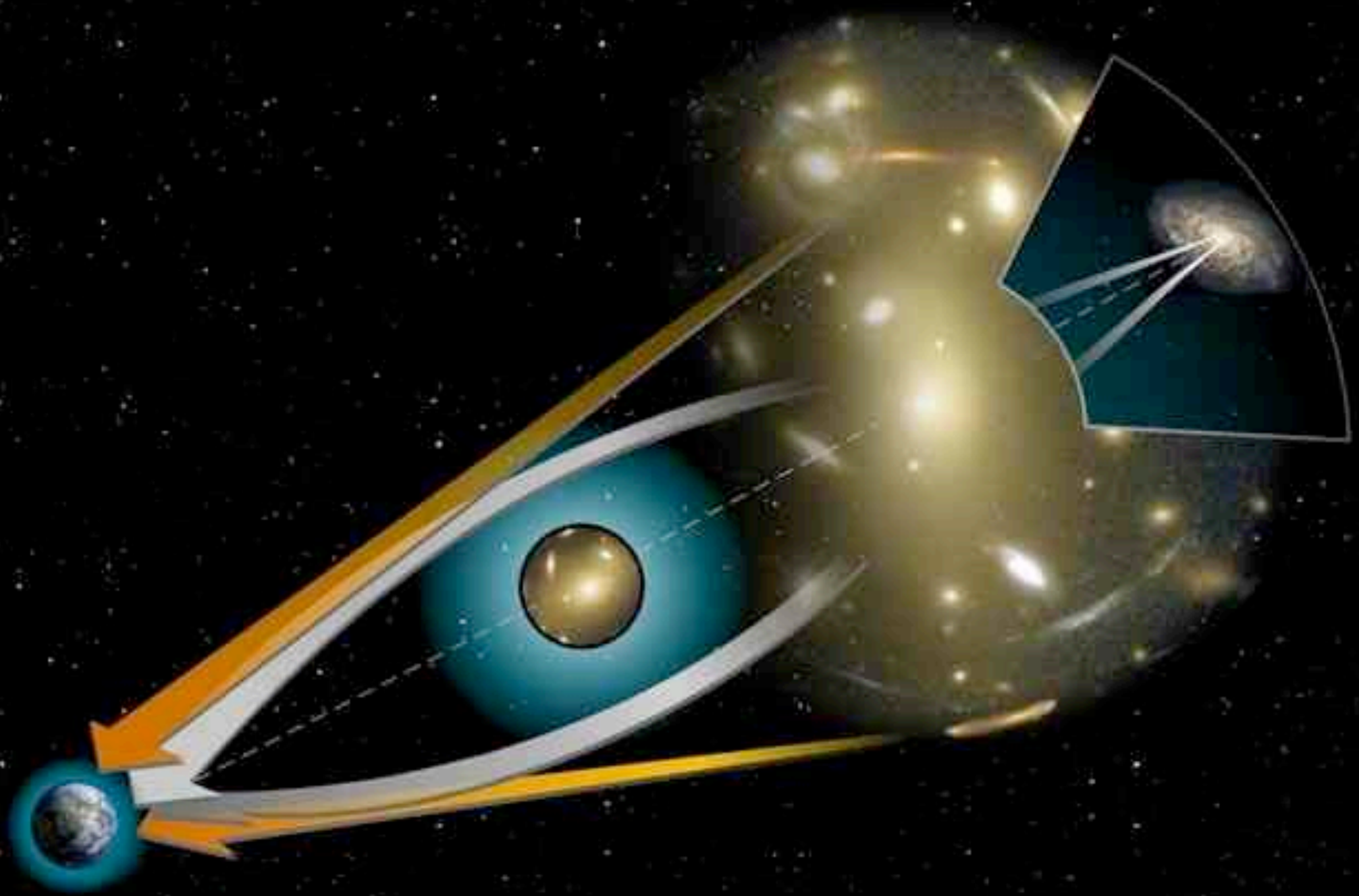
Visible Matter +
Dark Matter

NASA/STScI; ESO WFI; Magellan/U.Arizona/D.Clowe et al.

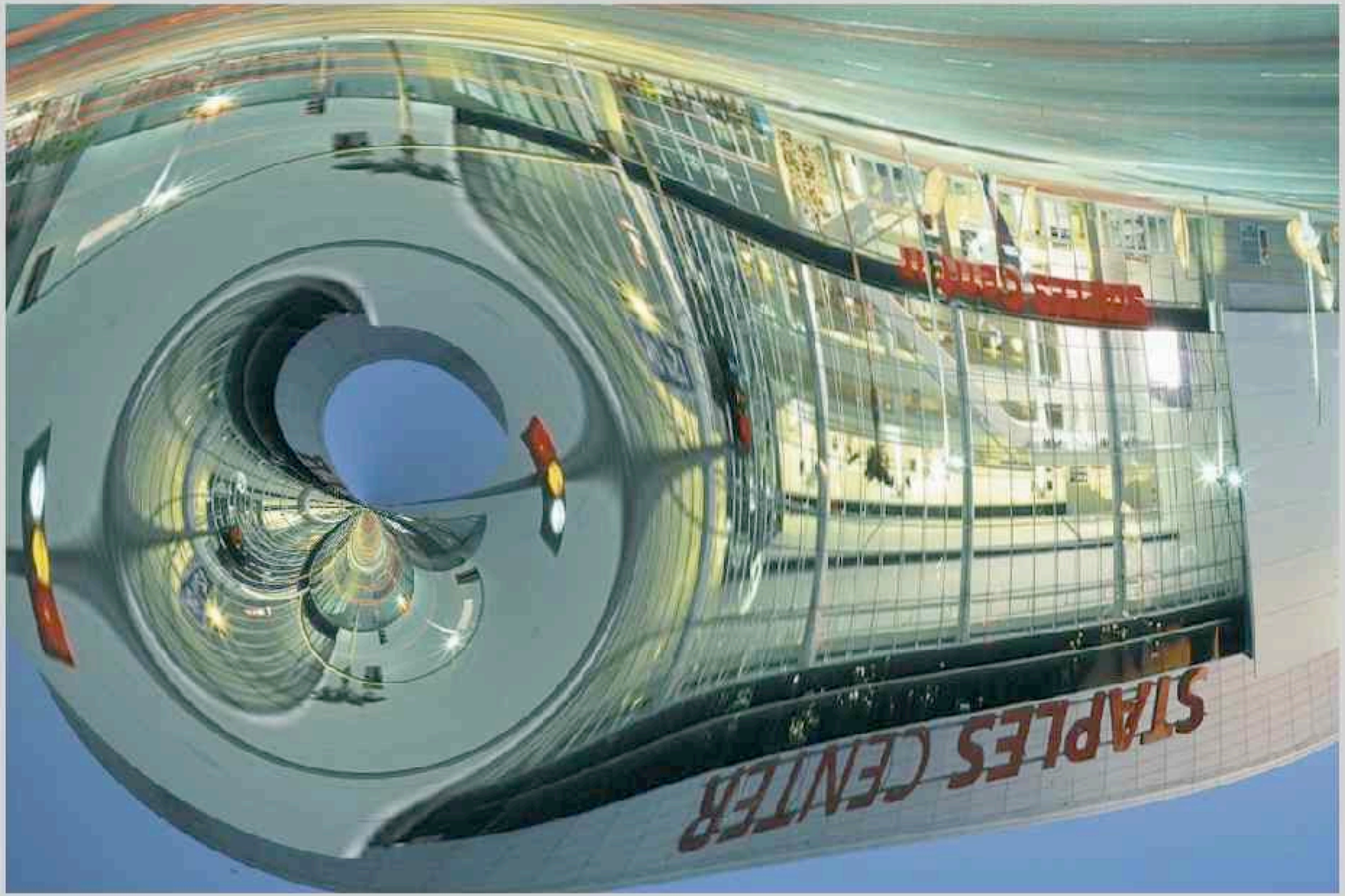
Dark Matter

NASA/STScI; ESO WFI; Magellan/U.Arizona/D.Clowe et al.

Gravitational lensing




STAPLES CENTER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