

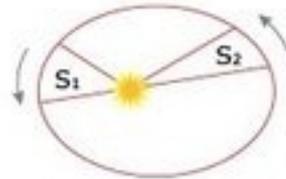
Empirical successes of Newton's theory of gravity

- All bodies fall at same rate near earth's surface.
- Moon's acceleration is $1/60^2$ smaller than acceleration at surface
- Explains all three of Kepler's laws of planetary motion:
 - Each planet moves in an ellipse with the sun at one focus
 - Planet moves faster when closer to the sun: equal area in equal time
 - Period² is proportional to (semi-major axis)³
- Jupiter's moons obey Kepler's 3rd law with different constant of proportionality
- Tides caused by gravity of moon, and sun: two high tides per day
- Comets move on highly elongated elliptical orbits
- Planets have a small gravitational effect on each other, e.g., Jupiter and Saturn
- Planet Uranus discovered with telescope in 1781. Planet Neptune discovered 50 years later because orbit of Uranus is perturbed by gravity of Neptune.

1st Law

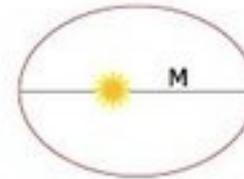


2nd Law



Equal area in the same time
area S₁ = area S₂

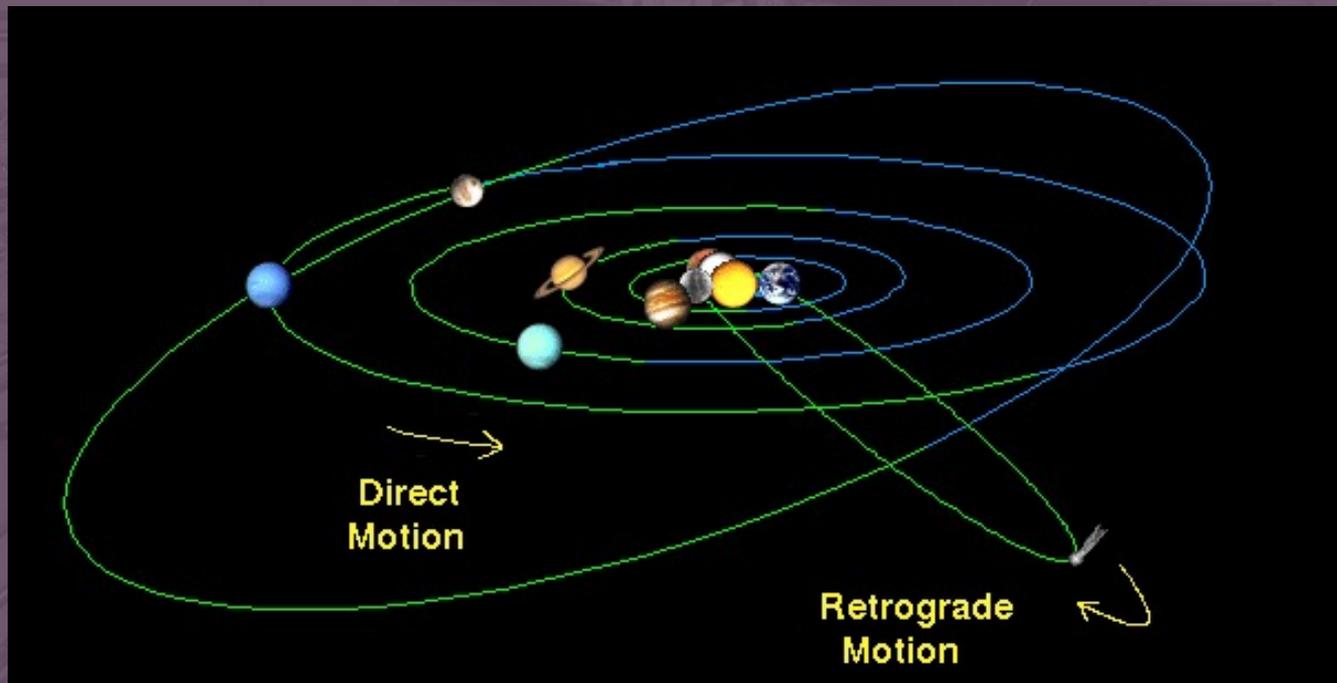
3rd Law

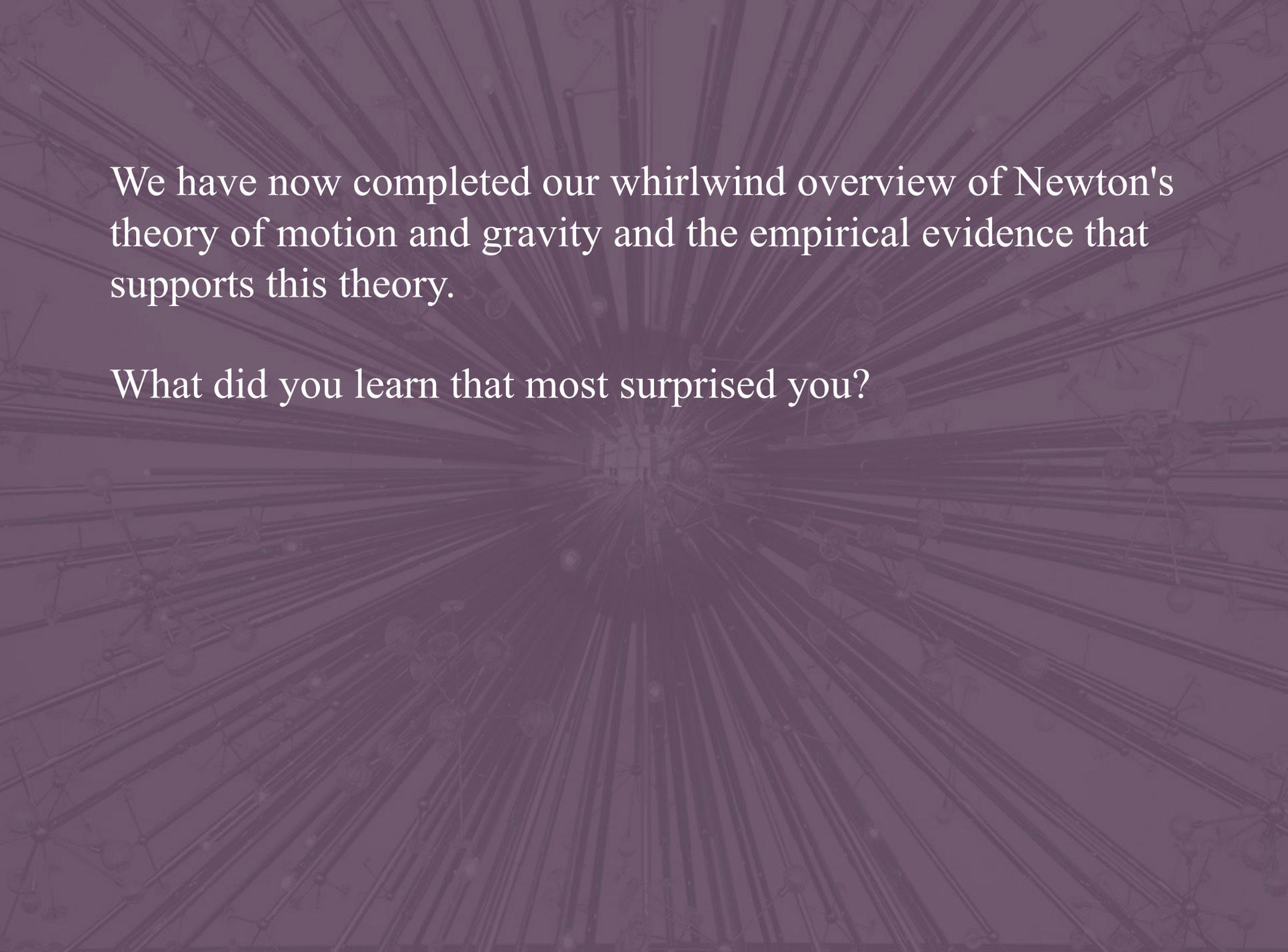


P: period (the time for one cycle)
M: length of the major axis

P^2/M^3 is the same for all planets

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We have now completed our whirlwind overview of Newton's theory of motion and gravity and the empirical evidence that supports this theory.

What did you learn that most surprised you?

The electromagnetic spectrum

