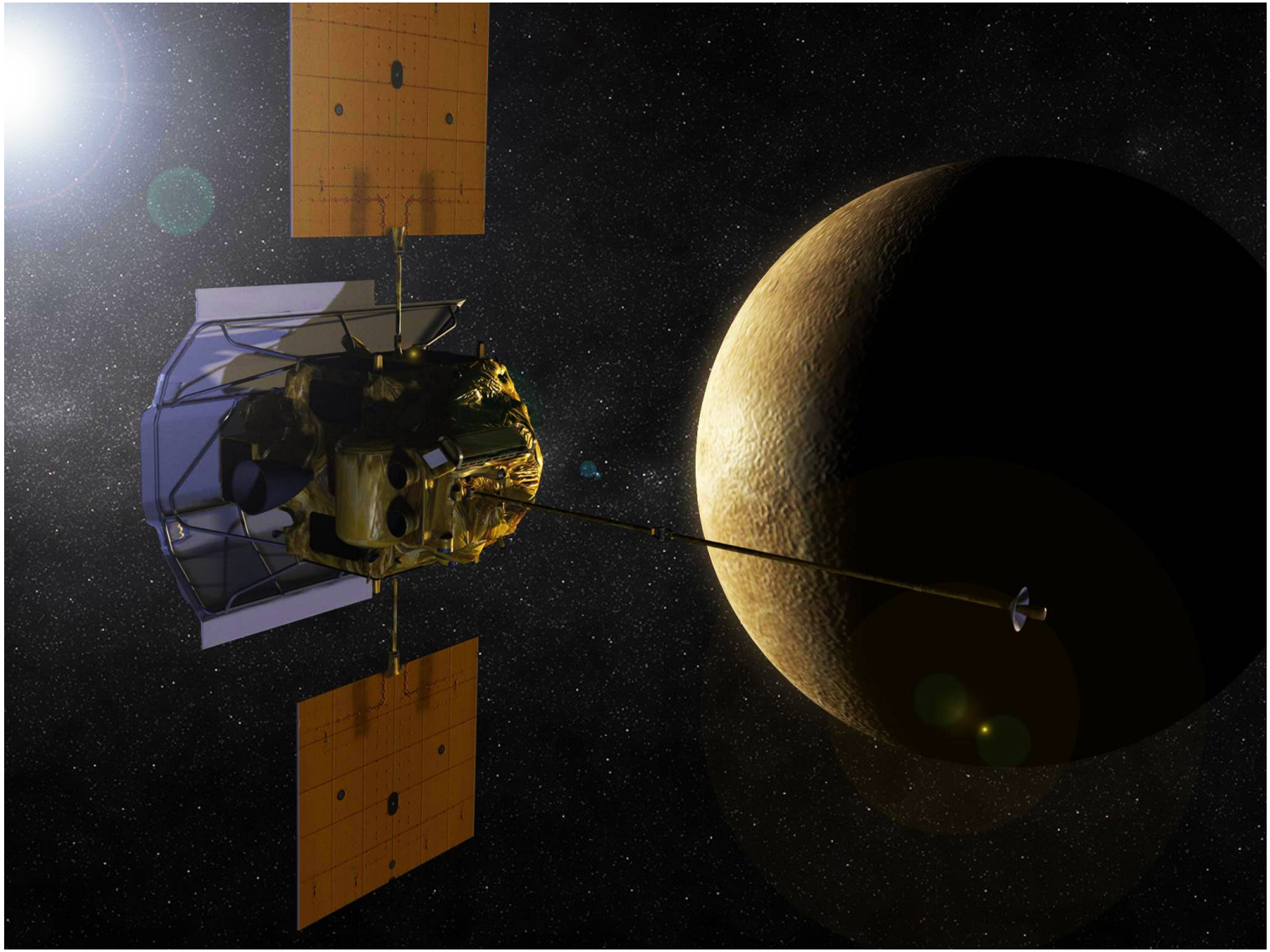
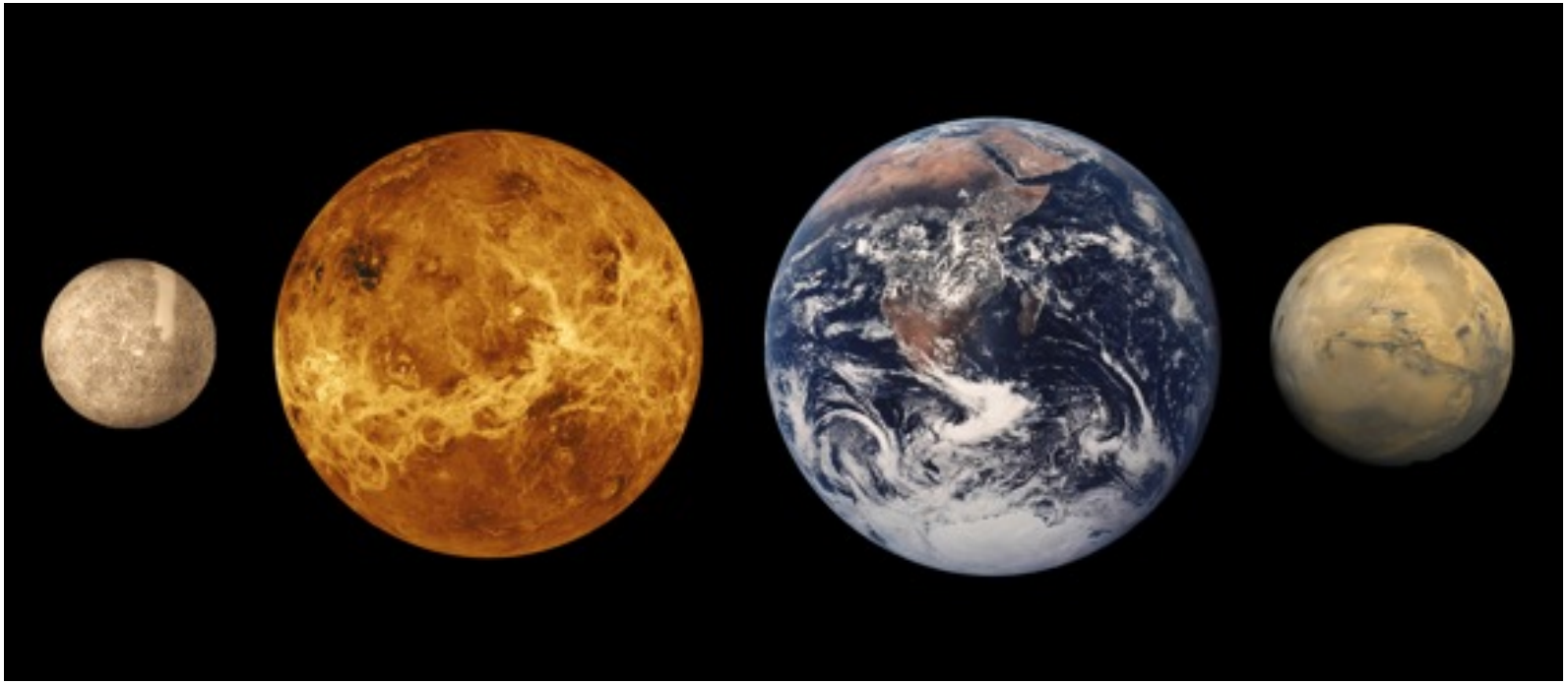
# The Planets



# Part 1: the terrestrial planets



# Mercury and Venus in the night sky

- Mercury is always very close to the Sun in the sky, is small in diameter, and is farther away than Venus. This makes it a difficult object to see. The legend is that Copernicus never saw it.
- Venus at times is the brightest object in the sky after the Moon; you can't miss it.

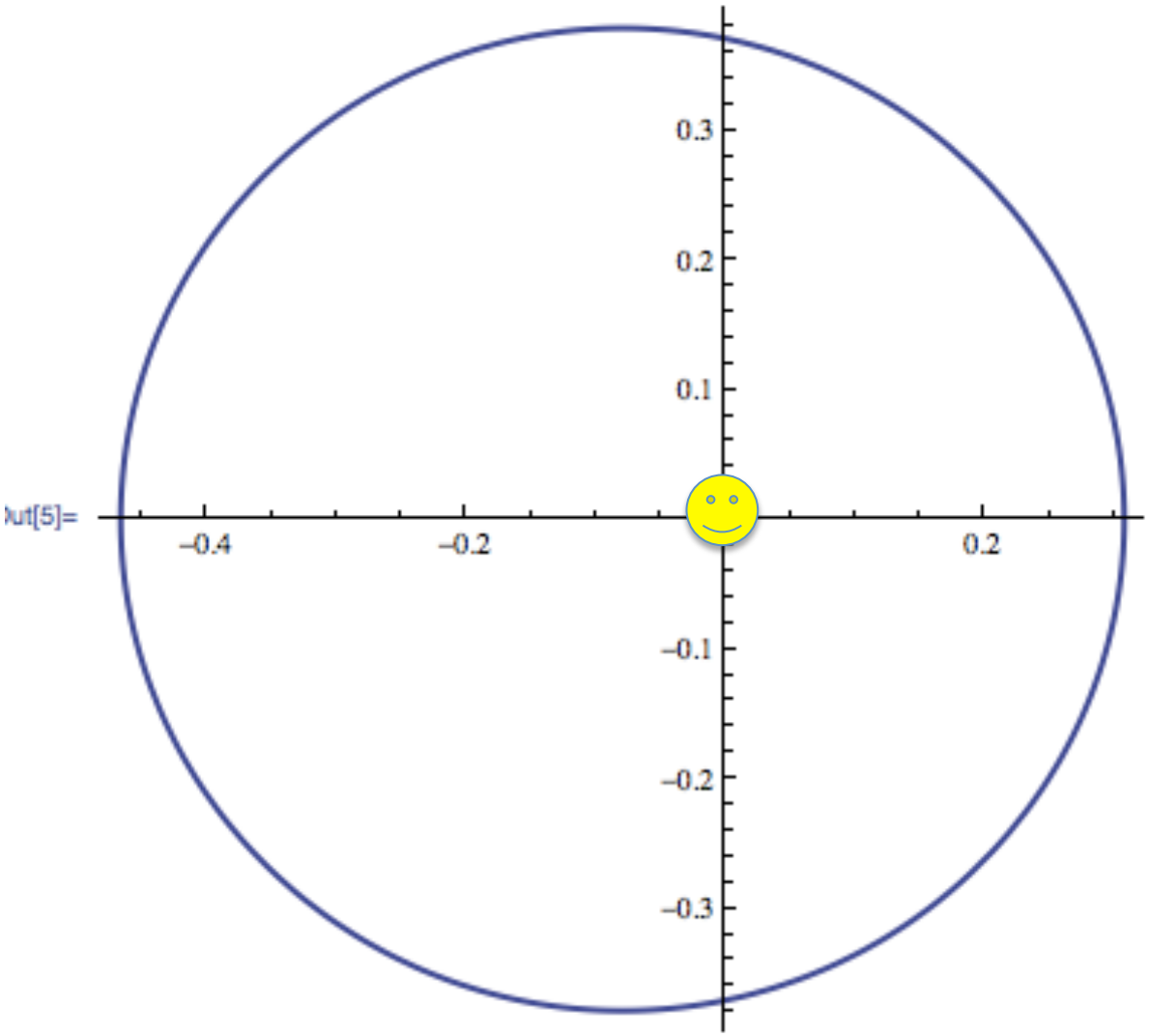
p. 46 God of Morning star

p. 46 God L lord of heliacal rise

# Basic facts of Mercury

- Semimajor axis of orbit:  0.3871 au
- Eccentricity of orbit: 0.206 (large for major planet)
- Inclination of orbit: 7.00 degrees
- Diameter: 4878 km (0.38 Earth diameters
- Mass: 0.055 Earth masses
- No atmosphere, surface heavily cratered

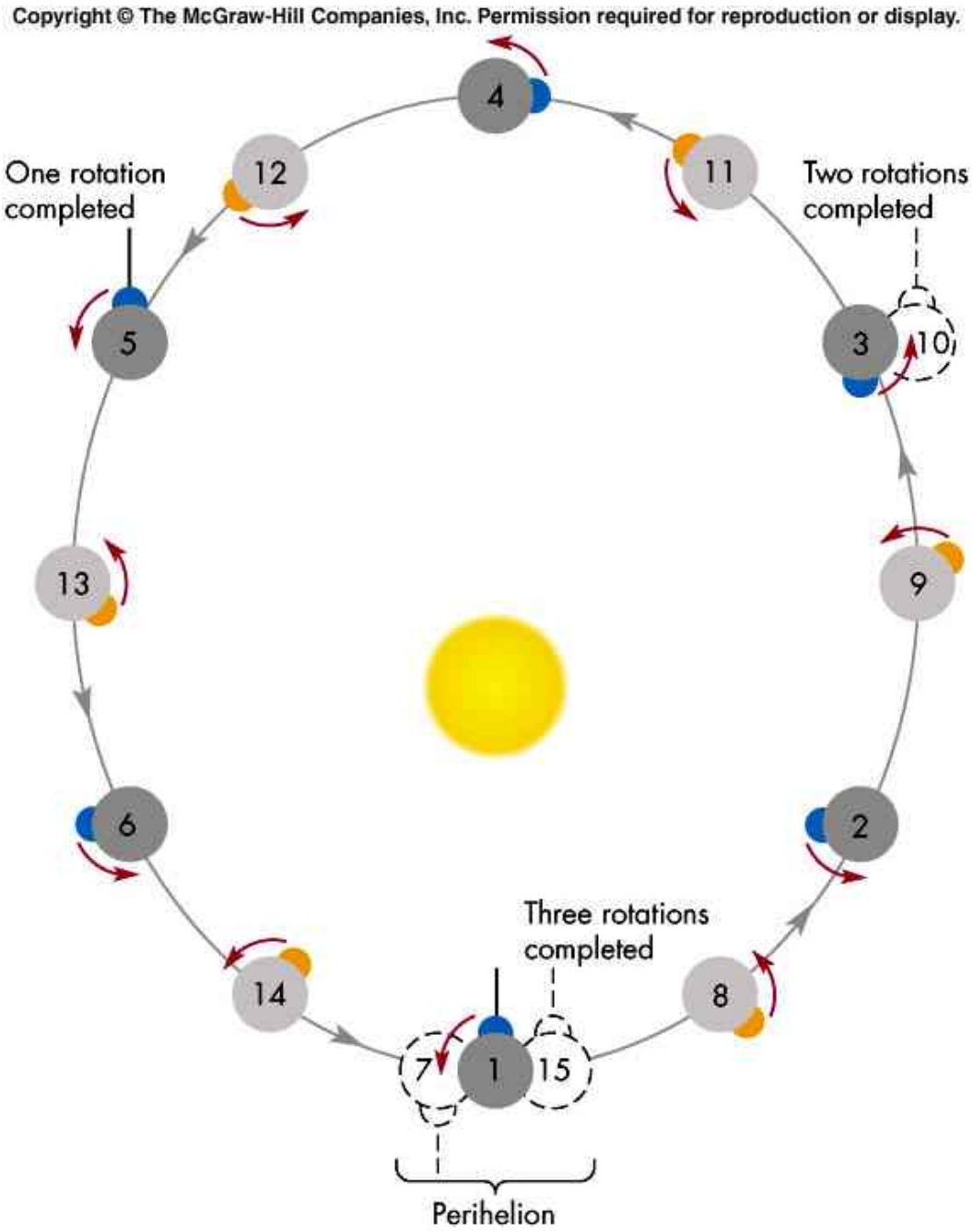
# Mercury: Closest of the Major Planets



# Interesting aspect of Mercury: the length of the day

Mercury is closest major planet to Sun, so tides are significant. For long time, it was believed to be synchronously rotating (like the Moon), with a rotation period equal to the revolution period of 88 days (87.97 days). In 1967 this was found not to be true. Mercury is in "2/3" resonance" (rotation period 58.65 days), meaning it undergoes 3 rotations for 2 revolutions

# 3/2 synchronous rotation and the weird day of Mercury



# The weird day on Mercury

- Weirdness is due to the fact that the rotation period is comparable to period of revolution, and that they are related by the ratio of 2/3 (see figure 10.3)
- An apparent solar day lasts 2 years!
- Only 2 longitudes have the noon when the planet is at *perihelion* (“hot poles”)
- Only 2 other longitudes have noon at *aphelion* (“warm poles”)
- From one of the hot poles, the Sun would rise quickly, linger around noon, then set fast

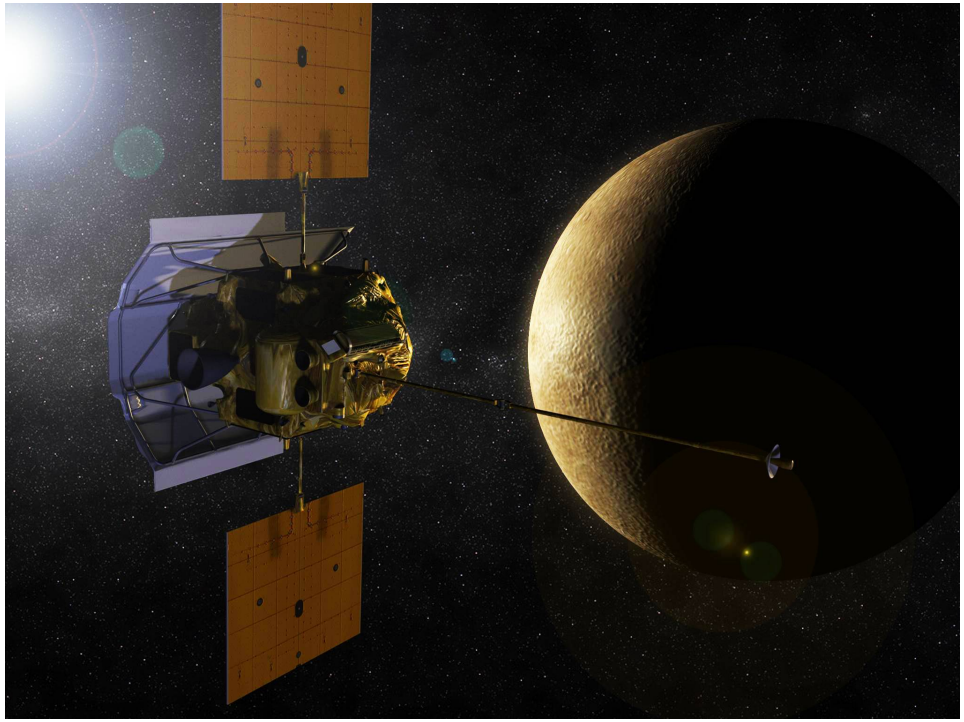
# Surface temperature on Mercury

Mercury is much closer to the Sun than the Earth, so the amount of solar heating is much larger (technically, the flux of solar radiation is larger by the square of the distances of the planets, which is $\frac{1.00}{0.387}^2 = 6.7$ times higher. In addition, daytime (when the Sun is above the horizon) lasts 88 days. As a result, the daytime temperature of Mercury is unbelievably hot. Surface temperatures can reach 700 K (700 degrees Kelvin), which is about 770 degrees Fahrenheit. Read the textbook about the Kelvin temperature scale. We will be using it the rest of the course.

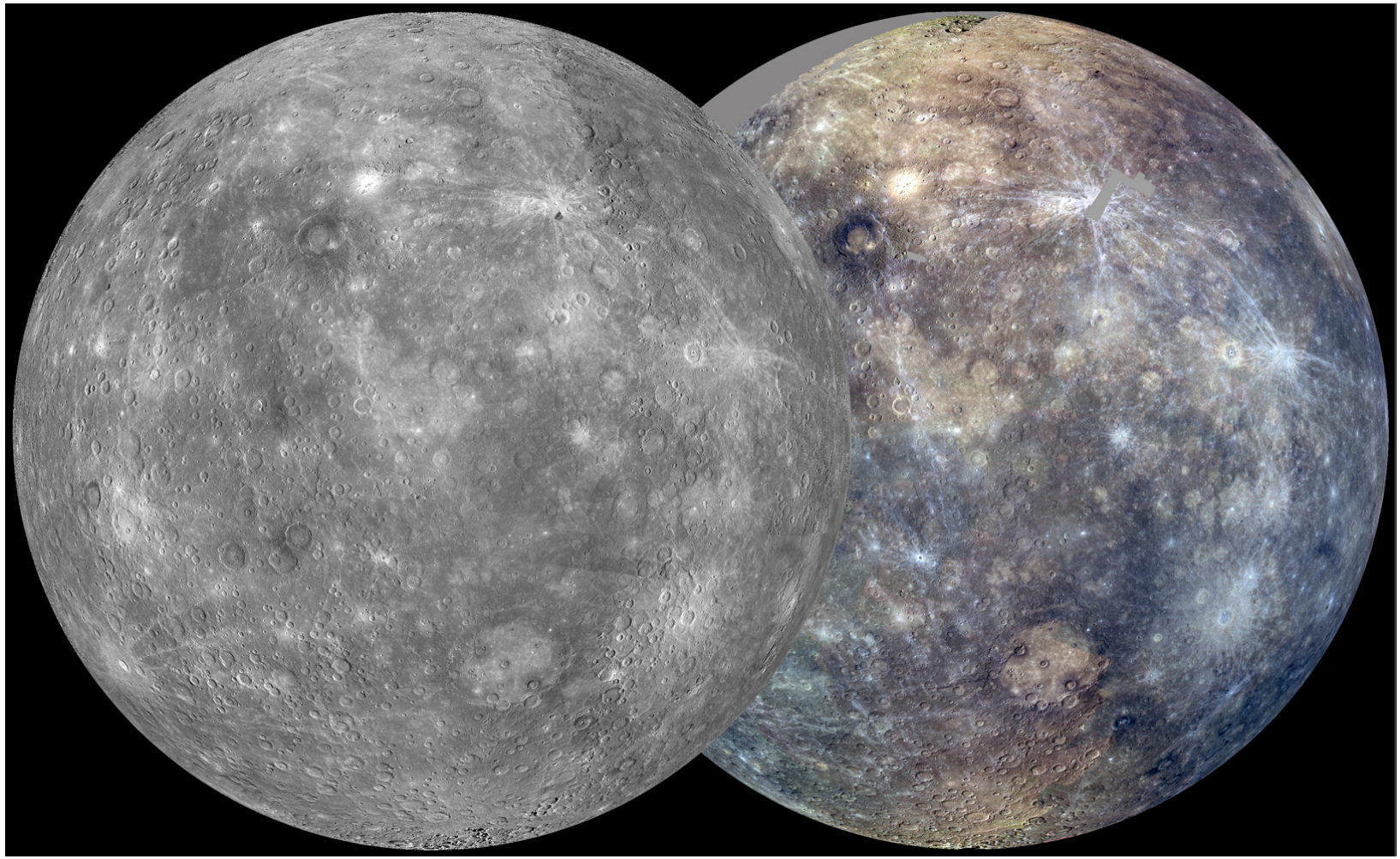
At nighttime, the Sun is absent from the sky for a revolution period of 88 degrees, so there is plenty of time for the surface of Mercury to cool off. Furthermore, *Mercury has no atmosphere to help retain the heat.* On the nighttime side, the temperature drops to 100 K, which is similar to temperatures in the outer solar system far from the Sun. The Kelvin temperature scale is described on p134 of your textbook. Read it.

# The Messenger mission to Mercury

- Launch: Aug. 3, 2004
- 1st Mercury flyby: Jan. 2008
- 2nd Mercury flyby: Oct. 2008
- 3rd Mercury flyby: Sept. 2009
- Orbital insertion: Mar. 2011



# A new age in the study of the planet Mercury



the Messenger spacecraft: a base at Mercury

# The geology of Mercury

What we can learn from its high mean density, magnetic field, and surface photography from Mariner 10 and the Messenger spacecraft