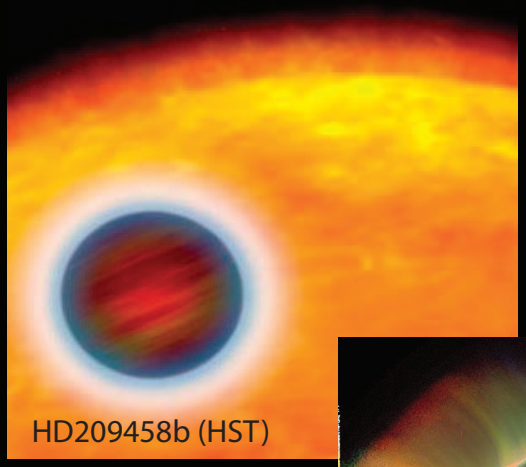
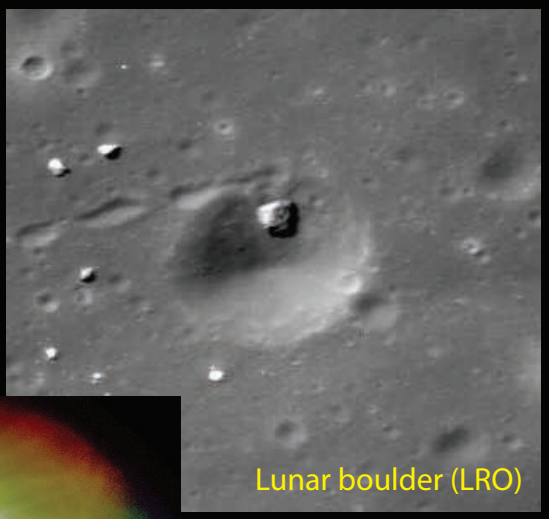
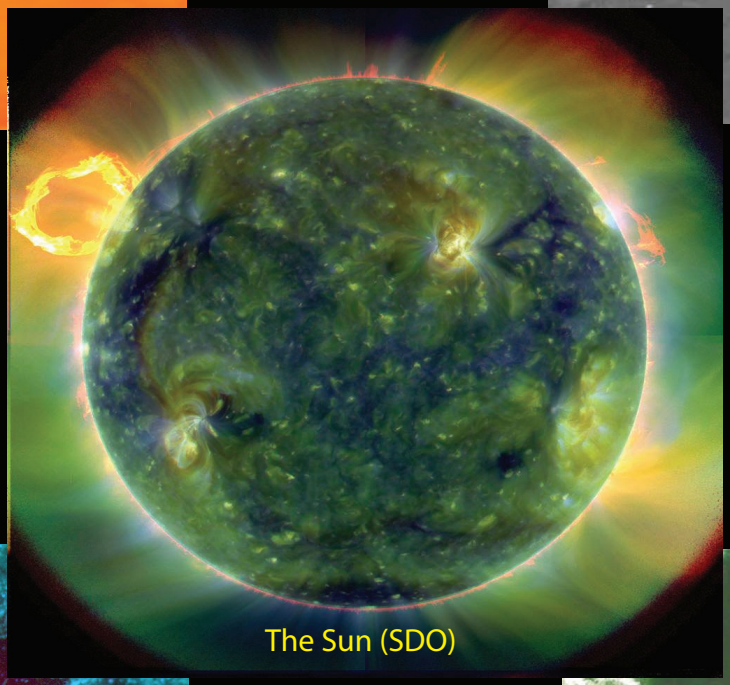
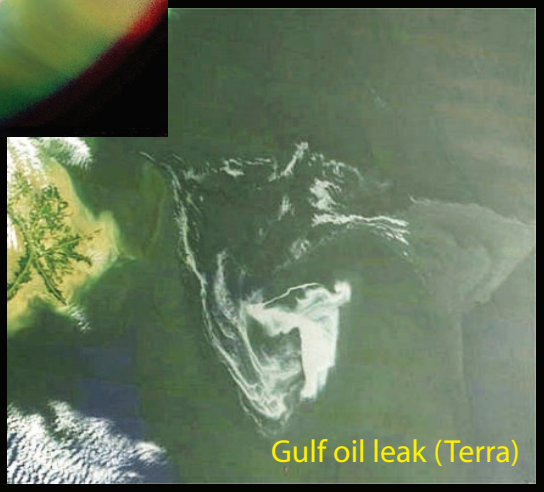
National Aeronautics and Space Administration


HD209458b (HST)


Lunar boulder (LRO)


The Sun (SDO)

Helix nebula (Spitzer)


Gulf oil leak (Terra)

See math ?

Top Left - Artist illustration showing the atmosphere of the exoplanet HD209458-b *(Hubble Space Telescope)*

Top Right - Image of a lunar boulder that has rolled into a crater *(LRO: Lunar Reconnissance Orbiter)*

Bottom Left - Infrared image of the Helix nebula showing different dust types *(Spitzer Space Telescope)*)

Bottom Right - 2010 Gulf oil leak as seen from space *(Terra)*

Center - High-definition image of the sun with an erupting prominence (SDO: Solar Dynamics Observatory)

Here are a few math problems that will help you interpret these images!

Scales - With a metric ruler, measure the width of the lunar boulder, sun, helix nebula and oil leak pictures. If the physical widths are 150 meters, 1,500,000 km, 2 light years and 275 km respectively, what is the scale of each image in the respective units per millimeter?

Exoplanets - The temperature of a planet orbiting a star like the sun, at a distance of D measured in Astronomical Units is given by the formula $T = 288/\sqrt{D}$. If Earth's distance in these units is D=1.0, over what range of orbit distances will liquid water be possible on that planet if water freezes at T = 273 K and boils at 373 K?

Moon Boulders - If the boulder is assumed to be a sphere with an average density of 3000 kg/m^3. From the size of the boulder in the image, what is the total mass of the bounder in metric tons?

The Sun - The erupting prominence seen as the bright loop on the left edge of the sun disk took about 23 minutes to get to the height shown in this image .About how fast was it traveling in kilometers/hour?

The Helix Nebula - The solar system has a diameter of 10 billion kilometers. If 1 light year = 9.5 trillion kilometers, how big would the solar system be at the scale of this image?

The Gulf oil leak - The oil producing the surface slick seen by the Terra/MODIS instrument emerged from a pipe about 1.8 feet in diameter, at a speed of about 2.5 feet/sec. If 1 cubic foot = 7.5 gallons, and the oil occupied 50% of the volume of the out-flowing volume of material, how many gallons per day of oil emerged from the pipe?

Answers: Scales: 2meters/mm; 15,000 km/mm; 0.0015 ly/mm and 3.8 km/mm. Exoplanets: For T=273K, D = 1.1 AU; for T=373 K, D= 0.6 AU. Moon Boulder: Mass = Density x Volume. Diameter = 10 meters, volume of sphere = 520 meter^3, so mass = 1,600 tons. The Sun: Height of prominence = 180,000 km, and 23 minutes = 0.38 hrs, average speed = 470,000 km/hr. Helix Nebula: The solar system is 0.001 light years in diameter, so at this image scale it would be 0.001/0.0015 = 0.7 mm in diameter. Oil leak: Area of pipe = 2.5 feet2. Flow volume = 2.5 feet^2 x 2.5 feet/sec = 6.3 feet^3/sec or 47 gallons/sec. In a day, this equals 0.5 x 47 gallons/sec x 86400 sec/day = 2 million gallons/day.

These problems are based on similar ones that you can find at the Space Math @ NASA website.

Visit the Space Math @ NASA website at

http://spacemath.gsfc.nasa.gov

to download over 200+ problems that apply math to all types of 'far out' space topics!

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