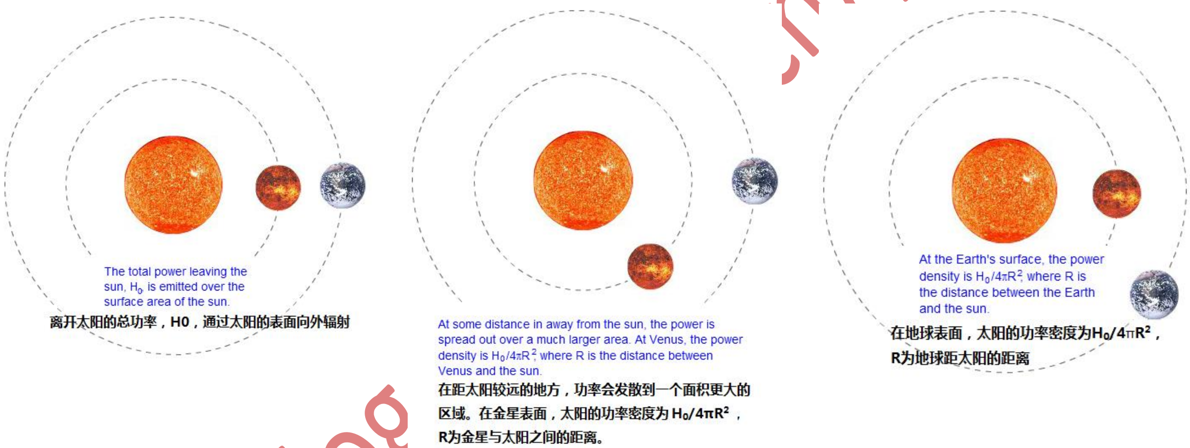
2.8 Solar Radiation in Space

太空中的太阳辐射

Only a fraction of the total power emitted by the sun impinges on an object in space which is some distance from the sun. The solar irradiance (H_0 in W/m^2) is the power density incident on an object due to illumination from the sun. At the sun's surface, the power density is that of a blackbody at about 6000K and the total power from the sun is this value multiplied by the sun's surface area. However, at some distance from the sun, the total power from the sun is now spread out over a much larger surface area and therefore the solar irradiance on an object in space decreases as the object moves further away from the sun.

在太空中，距太阳一定距离的物体上所接受的太阳辐射只是其总功率的一部分。太阳照度（表示为H_0，单位为瓦每平方米）指的是由于太阳照射在物体上入射的功率密度。在太阳表面，它相当于 6000 开尔文的黑体辐射出的功率密度，总功率即为功率密度乘以太阳的表面积。然而，在远离太阳的地方，总功率会发散到一个面积更大的区域上。因此，当太空中的物体远离太阳时，到其表面的太阳照度会减少。



The solar irradiance on an object some distance D from the sun is found by dividing the total power emitted from the sun by the surface area over which the sunlight falls. The total solar radiation emitted by the sun is given by σT^4 multiplied by the surface area of the sun ($4\pi R_{sun}^2$) where Rsun is the radius of the sun. The surface area over which the power from the sun falls will be $4\pi D^2$, where D is the distance of the object from the sun. Therefore, the solar radiation intensity, H_0 in (W/m^2), incident on an object is:

$$H_0 = \frac{R_{sun}^2}{D^2} H_{sun}$$

where:

H_{sun} is the power density at the sun's surface (in W/m^2) as determined by Stefan-Boltzmann's blackbody equation;

R_{sun} is the radius of the sun in meters as shown in the figure below; and

D is the distance from the sun in meters as shown in the figure below.

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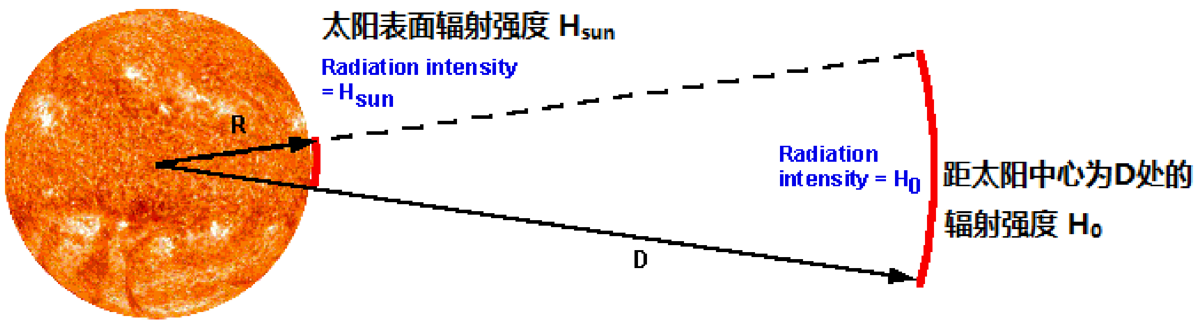
距离太阳为D的物体上的太阳照度可以通过将太阳辐射的总功率除以物体所在以太阳为球心的球面的总面积得到。太阳辐射的总功率可以通过将σT^4乘以太阳表面积（$4\pi R_{sun}^2$）得到，其中R_{sun}为太阳半径。当物体距离太阳为D时，阳光照射到此处的球面的面积为$4\pi D^2$。因此，入射到物体上的太阳辐射强度，H_0（单位：瓦每平方米）可由以下公式给出：

$$H_0 = \frac{R_{sun}^2}{D^2} H_{sun}$$

公式中H_{sun}为通过斯蒂芬·波尔兹曼黑体公式计算出的太阳表面的功率密度，单位为瓦每平方米；R_{sun}为太阳的半径，单位为米，如下图所示；D为物体距太阳的距离，单位为米，如下图所示。



At a distance, D, from the sun the same amount of power is spread over a much wider area so the solar radiation power intensity is reduced.

在距太阳为D的位置，等量的功率被发散到一个大了很多的面积上，因此太阳辐射的功率密度下降了。

距太阳距离-辐射强度计算器

Distance from the Sun - Radiation Intensity Calculator

据太阳距离
Distance from the Sun 778 x10^9m

阳光强度
Sunlight Intensity 47.82 W/m^2

The table below gives standardised values for the radiation at each of the planets but by entering the distance you can obtain an approximation.

下表给出了不同行星接收到的太阳辐射的标准值，通过输入该行星与太阳之间的距离，可以得到一个大概的太阳辐射的值。

Planet 行星	Distance ($\times 10^9$ m) 距离（单位：10^9米）	Mean Solar Irradiance (W/m^2) 平均太阳照度（瓦每平方米）
Mercury 水星	57	9116.4
Venus 金星	108	2611.0
Earth 地球	150	1366.1
Mars 火星	227	588.6
Jupiter 木星	778	50.5

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博主邮箱：nkukarl@gmail.com

Saturn 土星	1426	15.04
Uranus 天王星	2868	3.72
Neptune 海王星	4497	1.51
Pluto 冥王星	5806	0.878

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