Neighboring planets
邻近的行星

Rosa M. Ros, Ricardo Moreno

International Astronomical Union
Polytechnical University of Catalonia, Spain
Colegio Retamar de Madrid, Spain
国际天文联合会
加泰罗尼亚理工大学，西班牙
马德里 雷塔马学校，西班牙

Justification
前言

- This material is designed for teachers of children before starting primary school. Some content is presented to give the teacher more resources, although they may be too ambitious for such young children, but the questions that they may sometimes ask require broader knowledge to be able to rigorously explain the issues that may arise.
- 本教材是为学龄前儿童教师设计的。有些内容的呈现是为了给教师提供更多的资源。虽然这部分内容对学龄前儿童来说有些难，但是教师需要更广泛的背景知识才能恰当地给儿童解释他们提出的一些问题。

Goals
教学目标

- Show in a simple way the meaning of the data on the planets of the Solar System that often appear in texts.
- 用简单的方式展示文本中经常出现的太阳系行星数据的含义
- Introduce, by playing, the set of movements of the Solar System
- 以游戏形式介绍太阳系中一些列运动
- Discover the Moons surface
- 探索月球的表面
- Consider the surfaces of some planets and moons
- 思考一些行星和卫星的表面

Solar System
太阳系

- Models that are only manual work are not enough for us
- 仅仅是手工制作的模型对我们来说是不够的
- We want models with more content wich allow us to show some specific characteristics
- 我们希望模型拥有更多的内容以展示更多特定特征

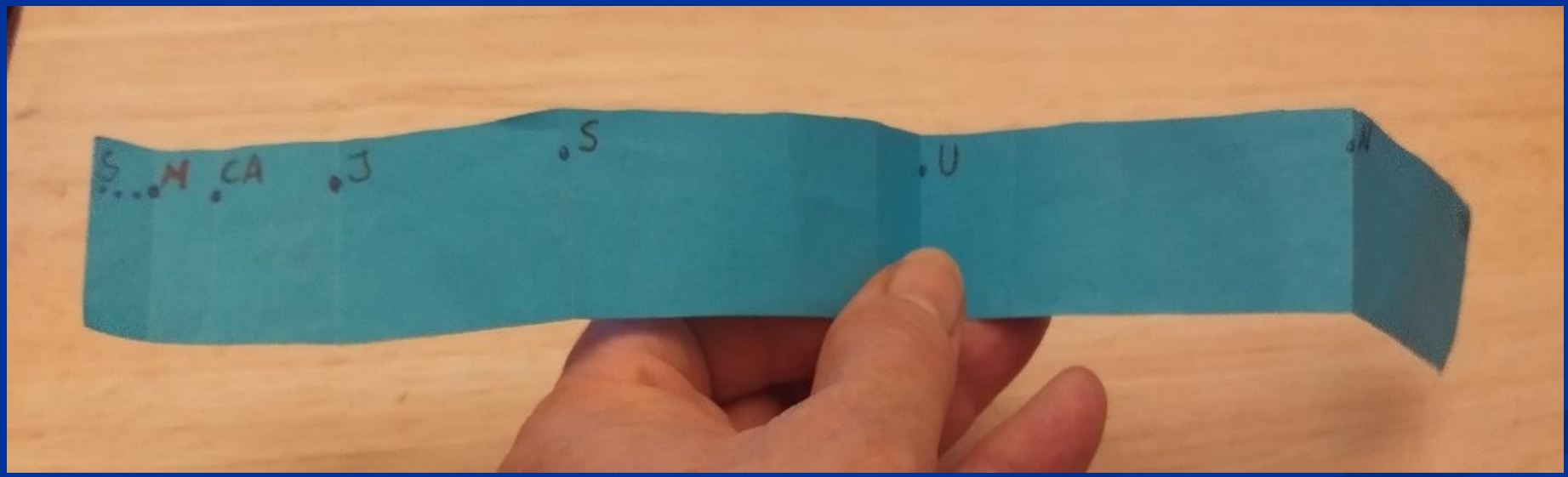
Activity 1: Distances to the Sun
活动1：到太阳的距离

We prepared a model using that approximately, the distance of one planet from the Sun is half the distance of the next planet from the Sun. For example, roughly the distance of Jupiter from the Sun is half the distance of Saturn from the Sun.

Planeta 行星	D. al Sol 到太阳的距离	D. inventadas 人为设定的距离
Mercury水星	57 900 000 km	67 500 000 km
Venus 金星	108 300 000 km	125 000 000 km
Earth 地球	149 700 000 km	187 500 000 km
Mars 火星	228 100 000 km	250 000 000 km
Asteroids Belt (average) 小行星带（平均值）	410 000 000 km	500 000 000 km
Jupiter 木星	778 700 000 km	750 000 000 km
Saturn 土星	1 430 100 000 km	1 500 000 000 km
Uranus 天王星	2 876 500 000 km	3 000 000 000 km
Neptune海王星	4 506 600 000 km	4 500 000 000 km
Kuiper Belt (average) 柯伊伯带	5 700 000 000 km	6 000 000 000 km

Activity 1: Distances to the Sun
活动1：到太阳的距离

- We cut a strip of DIN A4 card. We write an S (Sun) at one end and KB (Kuiper Belt) at the other end and fold it in half, placing the rest of the planets.
- 我们剪下一条 A4 卡纸。在一端写上 S（太阳），在另一端写上 KB（柯伊伯带），然后对折，把其余的行星图案放上去。



Activity 1: Distances to the Sun
活动1：到太阳的距离

Planets 行星	Initial serie 初始系列	+4	Titus-Bode D. 提图斯-波德距离	Real D. (UA)	Paper model 纸模型
Mercury水星	0	4	0.4	0.38	0.33
Venus 金星	3	7	0.7	0.72	0.65
Earth 地球	6	10	1.0	1.00	0.98
Mars 火星	12	16	1.6	1.52	1.25
Asteroids Belt 小行星带	24	28	2.8	2.73	2.50
Jupiter 木星	48	52	5.2	5.20	5
Saturn 土星	96	100	10.0	9.54	10
Uranus 天王星	192	196	19.6	19.20	20
Neptune海王星	384	388	38.8	30.06	30
Kuiper Belt 柯伊伯带	768	772	77.2	38.00	40

The Titius-Bode method begins in the first column with the series 0, 3, 6, 12, 24, 48, 96… in which each value is doubled. The second column shows the same numbers plus 4. In the third column, we divide all of them by 10, and the resulting values are quite similar to the distances (in astronomical units, AU) shown in the fourth column. The fifth column is the simp[illegible] model created by folding the paper.

提丢斯-波德法从第一列开始，数字序列为 0, 3, 6, 12, 24, 48, 96…，其中每个值都翻倍。第二列的数字与第一列相同，但都加了 4。第三列中，所有数字都除以 10，所得结果与第四列所示的距离（以天文单位 AU 为单位）非常接近。第五列是将纸张折叠后得到的简化模型。

Activity 1: Distances to the Sun
活动1：到太阳的距离

The basis of the model (half and half) is a simplified version of the Titius-Bode mnemonic.

This empirical rule was used in the 18th century to deduce the distances of the then-known planets. This law holds approximately true for the moons of Jupiter and Uranus, and also for those of Saturn, but with some gaps. It is currently being considered for the case of extrasolar planets.

该模型（一半一半）的基础是提丢斯-波德记忆法的简化版本。

这条经验法则在18世纪被用来推断当时已知行星的距离。该法则大致适用于木星和天王星的卫星，以及土星的卫星，但存在一些偏差。目前，人们正在研究将其应用于系外行星的情况。

Activity 2: Diameters
活动2：直径

Sun 太阳	1 392 000 km	→	139.0 cm
Mercury 水星	4 878 km	→	0.5 cm
Venus 金星	12 180 km	→	1.2 cm
Earth 地球	12 756 km	→	1.3 cm
Mars 火星	6 760 km	→	0.7 cm
Jupiter 木星	142 800 km	→	14.3 cm
Saturn 土星	120 000 km	→	12.0 cm
Uranus 天王星	50 000 km	→	5.0 cm
Neptune 海王星	45 000 km	→	4.5 cm

Activity 2: Diameters
活动2：直径

General scaled diameter model with the planets glued on the Sun.

行星粘在太阳上的一般比例直径模型。

Activity 3: Comparison of volumes
活动 3：体积比较

The volume of a sphere is 4/3 pi times the radius cubed. Therefore, if the radius of one planet is twice that of another, its volume is not just double, it's much larger.

As an example, let's compare Earth and Jupiter. Jupiter's radius is 11 times greater than Earth's, so Jupiter's volume is more than 1300 times greater (11 x 11 x 11 = 1331). To visualiz this, we can use a kilogram of chickpeas.

球体的体积等于半径的立方乘以 4/3π。因此，如果一个行星的半径是另一个行星的两倍那么它的体积不仅是两倍，而是大得多。

例如，我们来比较一下地球和木星。木星的半径是地球的 11 倍，所以木星的体积是地球的 1300 多倍（11 × 11 × 11 = 1331）。为了更直观地理解这一点，我们可以用一公斤鹰嘴来做个比喻。

Activity 3: Comparison of volumes
活动 3：体积比较

A chickpea is approximately 1 cm in diameter. We took a sufficiently large plastic bag and filled it with 1331 chickpeas. We sealed the bag into a spherical shape using transparent tape and compared it to a single chickpea.

鹰嘴豆直径约为1厘米。我们取一个足够大的塑料袋，装入1331颗鹰嘴豆。用透明胶带将袋子封成球形，并将其与一颗鹰嘴豆进行比较。

To count them, we'll use a measuring cup or small cup that allows us to count the chickpeas quickly. For example, if 100 chickpeas fit in the cup, we'll put 13 cups in the bag and then add 31 more chickpeas.

为了数鹰嘴豆，我们会用量杯或小杯子，这样可以快速计数。例如，如果一个杯子能装100颗鹰嘴豆，我们就先在袋子里放13杯，然后再加31颗。

Activity 4: Model of distances with movement
活动4：距离与运动模型

- We painted a circle on the floor of the patio with chalk to represent the orbit of each planet centered on the Sun.
- 我们用粉笔在院子的地板上画了一个圆圈，代表每颗行星以太阳为中心的轨道。

Activity 4: Model of distances with movement
活动4：距离与运动模型

Mercury水星	57 900 000 km		6 cm	0.4 AU
Venus金星	108 300 000 km		11 cm	0.7 AU
Earth地球	149 700 000 km		15 cm	1.0 AU
Mars火星	228 100 000 km		23 cm	1.5 AU
Jupiter木星	778 700 000 km		78 cm	5.2 AU
Saturn土星	1 430 100 000 km		143 cm	9.6 AU
Uranus天王星	2 876 500 000 km		288 cm	19.2 AU
Neptune海王星	4 506 600 000 km		450 cm	30.1 AU

Activity 4: Model of distances with movement
活动4：运动的距离模型

- A volunteer acts as a planet and will move following the chalk line until it completely circles the Sun. It is the translational or annual movement.
- 一名志愿者扮演一颗行星，沿着粉笔线围绕太阳旋转。这是公转或者周年运动
- Another volunteer does the same, but also with a simultaneous rotation movement on himself. Simulates daily rotation movement.
- 另一名志愿者做相同的运动，但是他自身也要绕着自己同时旋转。模拟每天的自转。
- A third volunteer is circling around the second: it is a moon around the planet.
- 第三个志愿者绕着第二个志愿者运动，相当于绕着行星的卫星。

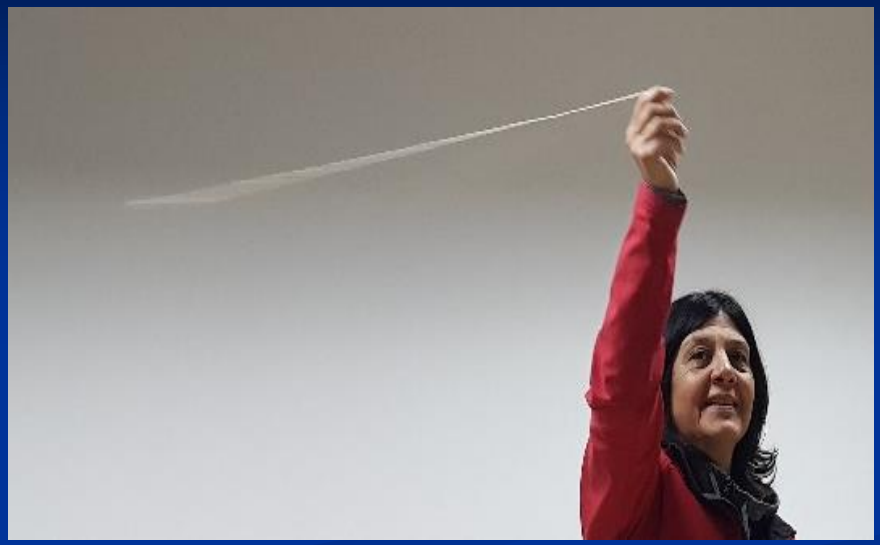
- It is necessary to mention that with these movements some can pass in front of the others or in the middle of the direction in which other planets are and cover each other: transits and eclipses occur.
- 需要指出的是，在这些运动中，有些行星可能会从其他行星的前面经过，或者从其他行星所在的方向中间经过，并相互遮挡：这就是凌日和日食的现象。

Activity 5: Orbital period model
活动5：轨道周期模型

- The translational movement is faster for the inner planets and slower for the outer ones.
- 内行星的公转速度较快，外行星的公转速度较慢。
- We will simulate this situation with a simple model. We hold a rope at the opposite end to which we have fixed a nut and we make it rotate like a sling above our head.
- 我们将用一个简单的模型来模拟这种情况。我们在绳子的另一端固定一个螺母，让它像吊索一样在我们头上旋转。

Activity 5: Orbital period model

- As we release the rope we will see that it takes more time to make a complete circle (an orbit).
- 当我们松开一截绳子时，我们会看到它需要更多的时间来完成一个完整的圆（一个轨道）。
- If we remove the rope, it takes less time to turn around (it is good to pass the rope through the inside of a small tube so as not to erode the hand if the rope is removed quickly)
- 如果我们收紧一截绳子时，螺母旋转一圈的时间会少一些（如果收紧得快，最好把绳子从小管子里面穿过，以免摩擦手）



Activity 6: Terrestrial and gaseous planets
活动6：类地行星和气态行星

Mercury水星	5.41 g/cm3	4 878 km
Venus 金星	5.25 g/cm3	12 180 km
Earth 地球	5.52 g/cm3	12 756 km
Mars 火星	3.90 g/cm3	6 760 km
Jupiter 木星	1.33 g/cm3	142 800 km
Saturn 土星	0.71 g/cm3	120 000 km
Uranus 天王星	1.30 g/cm3	50 000 km
Neptune 海王星	1.70 g/cm3	45 000 km

Activity 6: Terrestrial and gaseous planets
活动6：类地行星和气态行星

Terrestrial planets 类地行星

- Mercury, Venus, Earth and Mars. 水星、金星、地球和火星
- Smaller and closer to the Sun 更小，离太阳更近
- Without or with few satellites (0, 0, 1 and 2 respectively)
- 没有或者只有少量卫星（分别有0，0，1和2颗卫星）

Gaseous planets 气态行星

- Jupiter, Saturn, Uranus and Neptune.
- 木星、土星、天王星和海王星
- Bigger and farther from the Sun 更大，离太阳更远
- With many satellites 拥有更多的卫星
- With rings of ice and dust 拥有冰和尘埃组成的环

Activity 6: Terrestrial and gaseous planets
活动6：类地行星和气态行星

Terrestrial planet 类地行星

- Model of the Earth with modeling clay of 2.6 cm in diameter
- 用直径2.6厘米的粘土制作的地球模型

Credit: NASA

Activity 6: Terrestrial and gaseous planets

Gaseous planets 气态行星

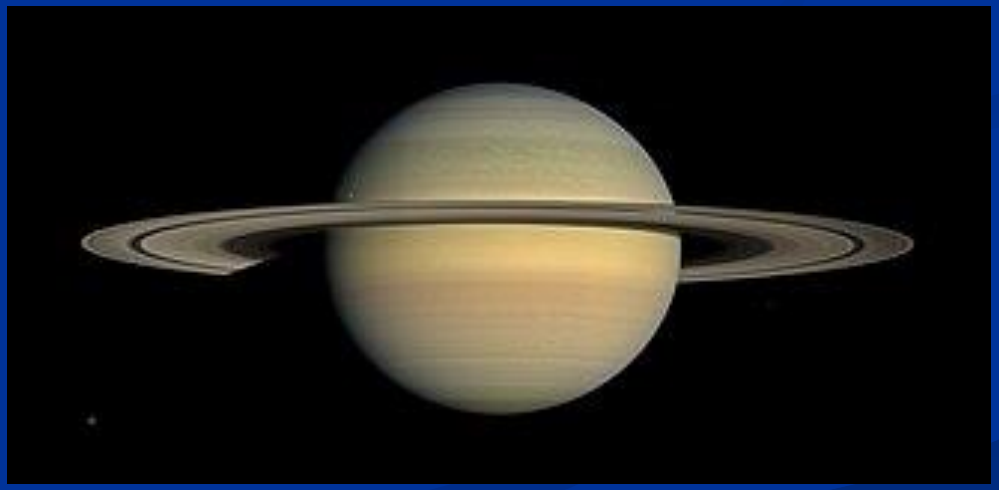
- Jupiter model with bubble paper, 28.5 cm in diameter
- 用气泡纸制作的直径为28.5厘米的木星模型

Credit: NASA

Activity 7: Planetary rings
活动7：行星环

Saturn is famous for its ring system visible from Earth. Jupiter, Uranus, and Neptune also have rings, though less spectacular. The rings, composed of dust, rocks, and ice, rotate in the planets' equatorial plane.

土星因其从地球上可见的环系而闻名。木星、天王星和海王星也有环，但不如土星的环那样壮观。这些环由尘埃、岩石和冰组成，围绕行星的赤道平面旋转。



The inner edge is 74,000 km from the center of Saturn and the outer edge is 140,000 km away (while the radius of Saturn is only 58,000 km).

土星内缘距离土星中心 74,000 公里，外缘距离土星中心 140,000 公里（而土星半径仅为 58,000 公里）。

Activity 7: Planetary rings
活动7：行星环

We used a DVD or CD and a polystyrene ball to simulate Saturn and its rings. We cut the ball in half and glued the two halves to either side of the CD or DVD.

To make the model to scale, keep in mind that the diameter of a CD or DVD is 12 cm, so, based on a simple proportion, we should use a polystyrene ball slightly less than 5 cm in diameter.

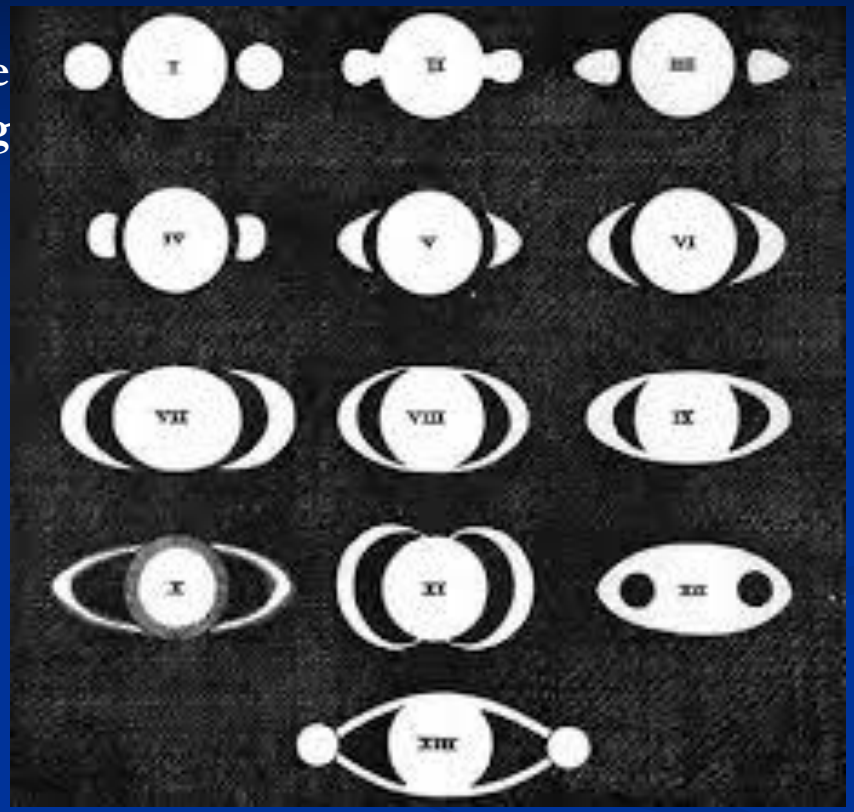
我们用一张DVD或CD和一个泡沫塑料球来模拟土星及其光环。我们将泡沫塑料球切成两半，分别粘在CD或DVD的两侧。

为了使模型比例合适，请记住CD或DVD的直径为12厘米，因此，根据简单的比例关系，我们应该使用直径略小于5厘米的泡沫塑料球。

Activity 7: Planetary rings
活动7：行星环

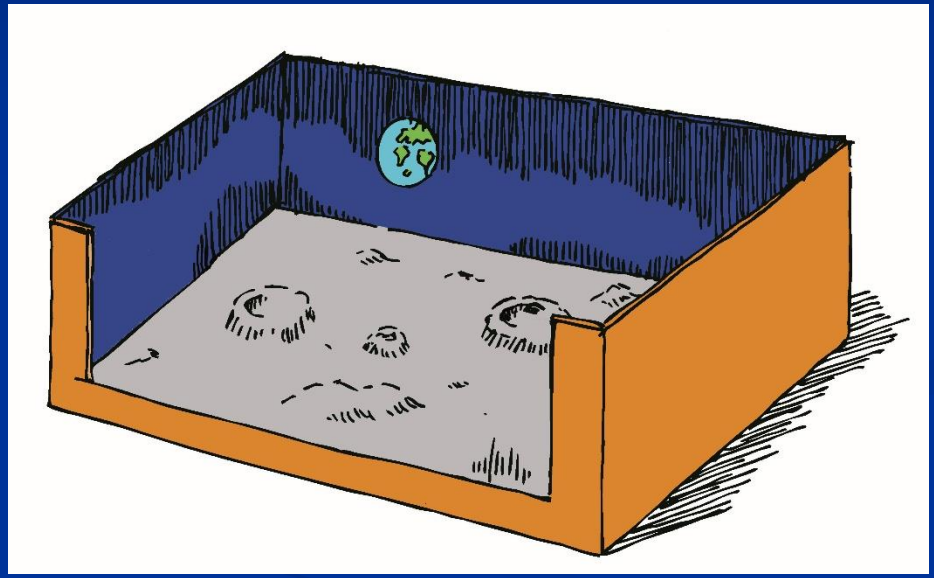
If we hold the model with two fingers at the poles, varying its position will show the ring tilted at different angles. These positions will be similar to what Galileo Galilei observed in 1610 with his small telescope.

如果我们用两根手指捏住模型的两极，改变模型的位置，就会看到圆环倾斜到不同的角度。这些角度与伽利略·伽利莱在1610年用他的小型望远镜观察到的现象类似。



Activity 8: Dioramas
活动8：立体模型

- **We know what the surface of the Earth, the Moon and Mars look like.**
- 我们知道地球、月球和火星的表面看起来是什么样子的。
- **We make dioramas of each of these places.**
- 我们制作了上述每种天体表面的立体模型。
- **We simulate the surface with craters or not, and we paint the sky.**
- 我们模拟了包含或者不包含陨石坑的表面，并且绘制了天空。



- The light of the Sun is colorful. In the atmosphere of the Earth, due to its composition, the blues have "won", in that of Mars the pinks "won" and on the Moon there is no atmosphere and the sky looks black
- 阳光是五颜六色的。在地球大气中，由于它的组成成分，蓝色“胜出”，在火星大气中，粉红色“胜出”，而在月球上没有大气，天空看起来是黑色的。

Activity 8: Diorama of Mars
活动8：火星的立体模型

The surface of Mars is reddish due to iron oxides.
由于氧化铁的存在，火星表面呈显出红色。

Credit: NASA

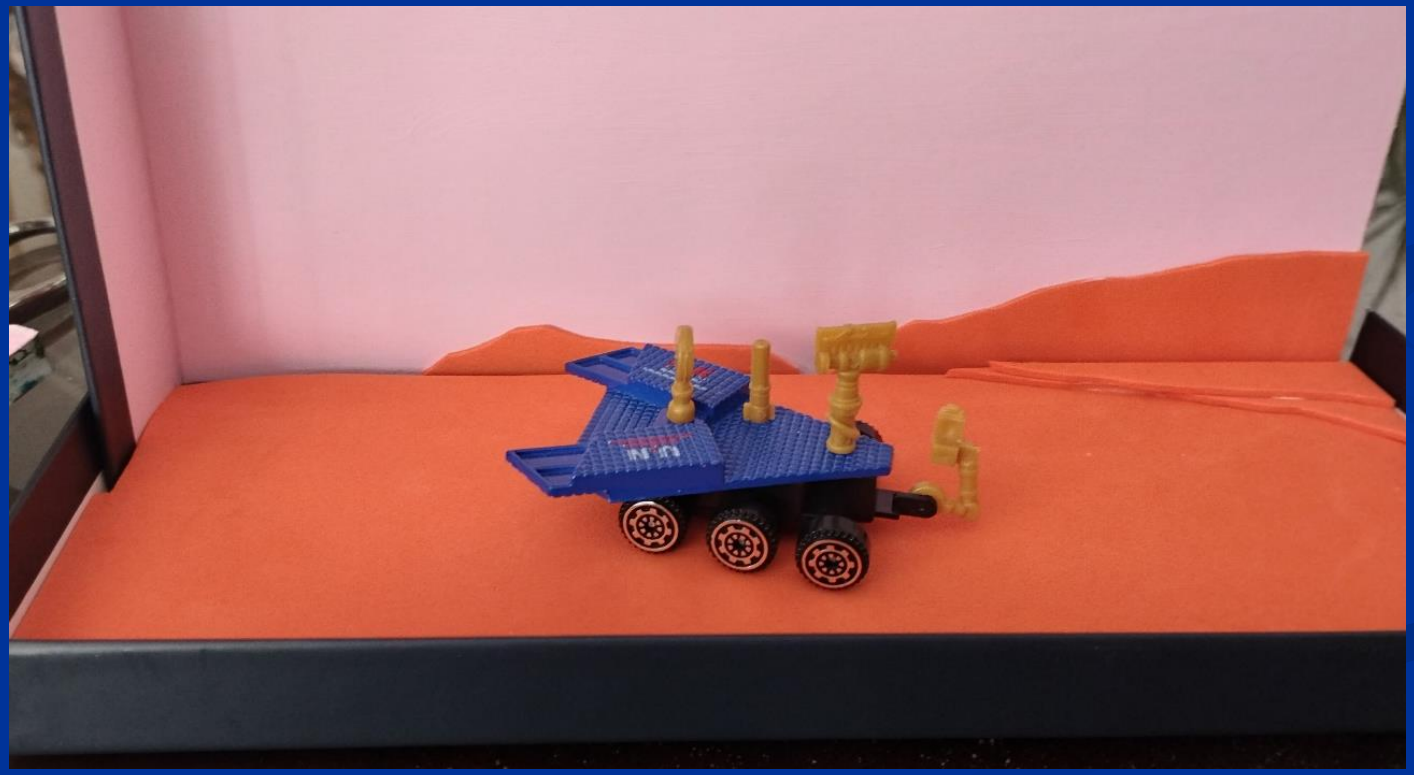
Credit: NASA

The atmosphere of Mars is very weak and there is a lot of dust in suspension, so the sky looks pink-orange. You have to paint the sky pink or orange. You can put a "rover" whose design does not need to be aerodynamic!
火星的大气非常稀薄，并且悬浮着大量的尘埃，所以天空看起来是粉橙色的。你必须把火星的天空涂成粉色或橙色。你可以放一个火星车，它的设计不要是空气动力学的！

Activity 8: Diorama of Mars
活动8：火星的立体模型

Example of the reddish surface of Mars, the pink atmosphere and the non-aerodynamic "rover"

火星的红色表面，粉红色的大气和非空气动力学的火星车的示例模型。



Activity 8: Diorama of the Moon
活动8：月球的立体模型

We simulate the surface of the Moon with powdered cement, ash or with flour and cocoa. It must have craters.

我们用粉状水泥、灰或面粉、可可粉来模拟月球的表面。它的表面必须有陨石坑。

On the Moon, since there is no atmosphere, you have to paint the sky black and maybe... put an astronaut in a diving suit, there is no air to breathe.

在月球上，由于这里没有大气，你不得不把天空涂成黑色。也许可以放一个穿着宇航服的宇航员，因为这里没有可以呼吸的空气。

Credit: NASA

Credit: NASA

Activity 8: Diorama of the Moon
活动8：月球的立体模型

Example of the surface of the Moon with craters, black sky and an astronaut in a diving suit, because there is no air to breathe.

拥有陨石坑的月球表面，黑色的天空和由于没有可以呼吸的空气而穿着宇航服的航天员的示例模型。

Activity 8: Diorama of the Earth
活动8：地球的立体模型

The Earth's surface usually has vegetation and you can put some animal, it is the planet of life and perhaps... an aerodynamic car

地球表面通常有植被，并且你可以放一些动物，这是一个拥有生命的星球，也许可以再放一辆空气动力汽车。

Credit: Martingraf

Credit: Pixabay

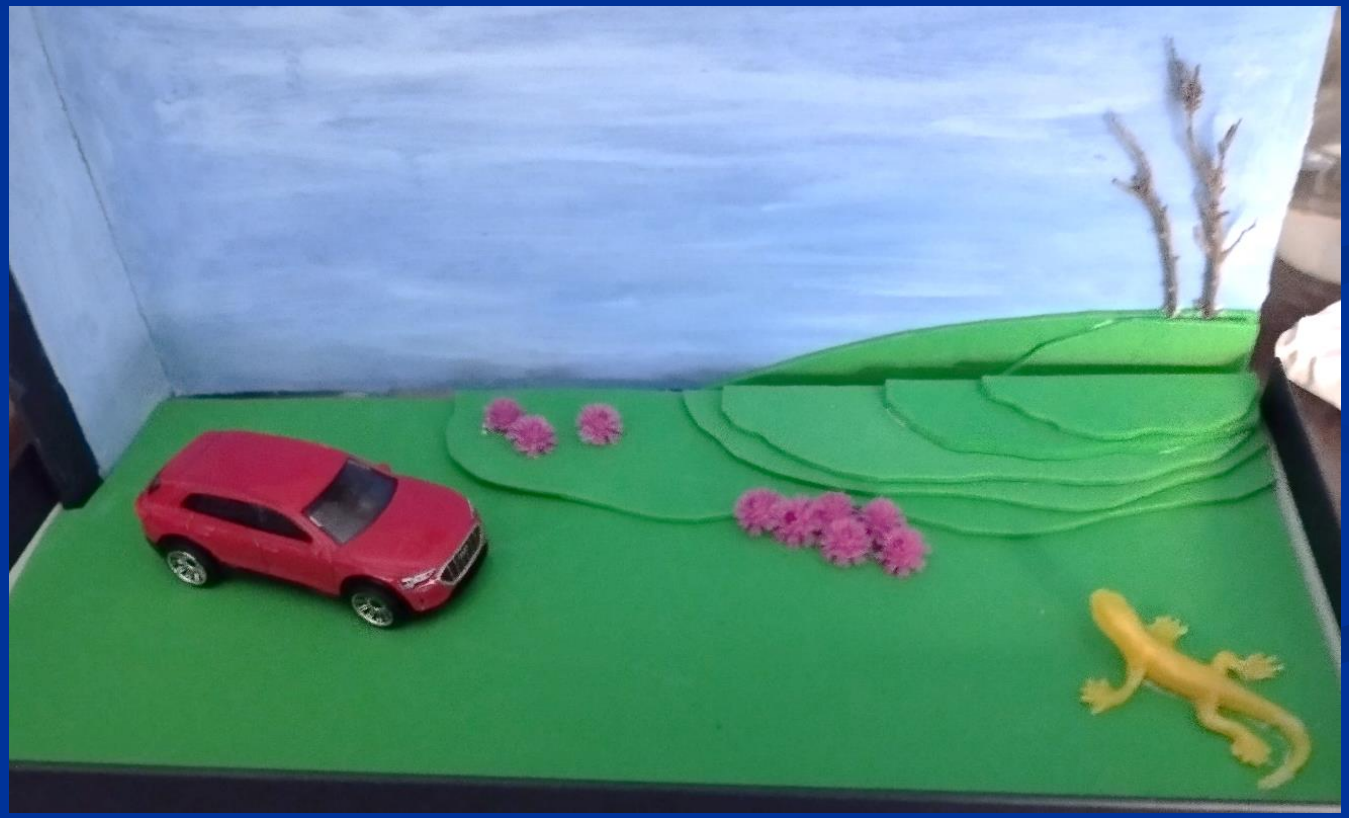
The Earth's atmosphere is much denser than that of Mars. You have to paint the sky blue.

地球的大气比火星的密度大得多。你需要把天空涂成蓝色。

Activity 8: Diorama of the Earth
活动8：地球的立体模型

Example of the Earth's surface with the blue sky, vegetation and some small animals and an aerodynamic car

拥有蓝色天空的地球表面，植被和一些小动物，一辆空气动力汽车的示例模型。



Smell on some planets
某些星球上的气味

The Earth's atmosphere diffuses the molecules responsible for smells. When these reach our noses, they dilute and are detected by specialized sensors, then interpreted by the brain. An atmosphere is necessary for the propagation of smells.

Let's consider what smells would be like on the Moon (where a spacecraft has landed) and on Mars or Venus (where several spacecraft have landed).

地球大气层会扩散产生气味的分子。当这些分子到达我们的鼻子时，它们会被稀释，并被专门的嗅觉感受器检测到，然后由大脑进行解读。大气层是气味传播的必要条件。

让我们设想一下，在月球（已有探测器着陆）、火星或金星（已有多个探测器着陆）上，气味会是什么样的呢？

Smell of the Moon
月球的味道

- On the Moon without an atmosphere you can't smell anything.
- 在没有大气的月球上，你什么也闻不到。
- The astronauts who walked on the Module returned to the module with small amounts of lunar dust in their suits and most of them agree that its smell is reminiscent of a mixture between ashes and "burnt gunpowder", like "chimney ashes".
- 在月球上行走的宇航员穿着宇航服返回太空舱时，身上会带着少量的月球尘埃。他们中的大多数人普遍认为，这些尘埃闻起来会让人想起灰烬和"燃烧的火药"的混合物，就像"烟囱灰"。

Smell of Venus
金星的气息

Venus's atmosphere is very dense, composed mainly of CO_2 (odorless) and sulfuric acid (odorless). We know that sulfuric acid rain occurs there, and rivers and lakes of this acid form. Various sulfur compounds are found on the surface of Venus, some of which smell like rotten eggs.

金星的大气层非常稠密，主要由二氧化碳（无味）和硫酸（无味）组成。我们知道金星上会下硫酸雨，并形成由这种酸性物质构成的河流和湖泊。金星表面存在多种硫化物，其中一些闻**起来像臭**鸡蛋。

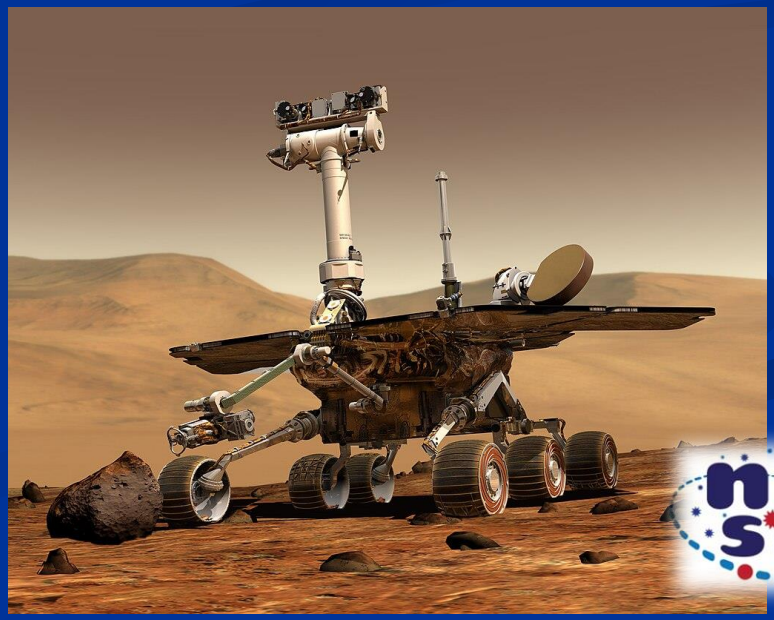
Smell of Mars
火星的味道

The “rovers” have revealed that the Martian atmosphere is rich in CO2 (96%), which does not contribute any aroma to the environment, but is also composed mainly of iron, magnesium, sulphur and acids. It may have a certain ferrous odor due to the abundant iron oxides in the powder.

探测车显示，火星大气富含二氧化碳（96%），二氧化碳本身不散发任何气味，但其主要成分还包括铁、镁、硫和酸。由于粉末中含有大量的氧化铁，火星大气可能略带铁锈味。

Presumably the surface must give a certain ferrous smell due to iron oxides

想必表面会因为含有氧化铁而散发出某种铁锈味。



Smell of space
太空的气味

Helen Sharman, the first British astronaut on Mir, explains that there is very little smell because in microgravity, warm air doesn't rise, and so "the smell of hot food" doesn't escape from the plate.

第一位登上和平号空间站的英国宇航员海伦·沙曼解释说，那里几乎没有气味，因为在微重力环境下，暖空气不会上升，所以“热食的气味”不会从盘子里散出去。

Many astronauts have said that after a spacewalk, they perceive "a smell of welding, of metal in the air, of burnt electrical wiring." The cause of this smell is a mystery, but it is noticeable.

许多宇航员都表示，太空行走后，他们会闻到“空气中弥漫着焊接、金属和电线烧焦的气味”。这种气味的成因至今仍是个谜，但确实很明显。

Activity 9: Smells on the Moon, Venus and Mars
活动 9：月球、金星和火星上的气味

MOON 月亮

We can recreate the smell of spacesuits by:
我们可以通过以下方式重现宇航服的气味：

- smelling the ashes of a bonfire or burning paper.
- for the smell of gunpowder, we can use sparklers or firecrackers from festivals or birthday parties.

- 闻一闻篝火灰烬或燃烧纸张的气味。

- 至于火药味，我们可以使用节日或生日派对上的仙女棒或鞭炮。

Activity 9: Smells on the Moon, Venus and Mars
活动 9：月球、金星和火星上的气味

VENUS 金星

Sulfuric acid doesn't smell, but sulfur compounds that smell like rotten eggs can be simulated with a "smel bomb" like the ones used for parties and magic tricks.

硫酸本身没有气味，但可以用类似派对和魔术表演中使用的**“气味炸弹”来模**拟有臭鸡蛋气味的硫化物。

Activity 9: Smells on the Moon, Venus and Mars
活动 9：月球、金星和火星上的气味

MARS 火星

To simulate the smell on Mars, we suggest using arid and very dry soil mixed with a collection of rusty nails or screws that will simulate the smell of the dust formed by iron oxides that give the typical reddish color to the Martian surface.

为了模拟火星上的气味，我们建议使用干燥的土壤，并混合一些生锈的钉子或螺丝，这样可以模拟由氧化铁形成的尘埃的气味，这种尘埃使火星表面呈现出典型的红色。

Life in the Solar System
太阳系中的生命

For life to exist:

- The planet must be in a habitable zone for liquid water to exist, and an atmosphere is needed to maintain humidity.
- Sunlight must interact with the atmosphere to generate, for example, ozone, which protects against ultraviolet radiation (which destroys living cells).
- It must have a surface like Earth's, which heats up and then heats the atmosphere.

生命存在的必要条件：

- **行星必**须位于适宜居住的气候带，液态水才能存在；大气层则需**要**维持湿度。
- **阳光必**须与大气层相互作用，才能产生臭氧等物质，臭氧可以抵**御紫外**线辐射（紫外线会破坏活细胞）。
- **行星必**须拥有类似地球的表面，表面会升温，进而加热大气层。

Many things are needed for life to progress: a star that isn't too large, a rocky planet at the right distance from its star, water, an atmosphere, and a suitable temperature and humidity...

生命的演化需要许多条件：一颗不太大的恒星，一颗距离恒星距**离合适的岩**质行星，水，大气层，以及适宜的温度和湿度……

Activity 10: Sprouted Chickpeas
活动 10：发芽的鹰嘴豆

Life requires a certain temperature, light, and humidity. Let's look at an example using four chickpeas wrapped in cotton inside a glass.

- We will put a chickpea in a cotton ball soaked with water (which we will keep always moist) inside a small glass. We will place 1 chickpea on a cotton ball soaked in water (which we will keep moist at all times) inside a small glass. We repeat this four times and place them in:
  - a sunny spot
  - a spot with almost no light
  - inside a refrigerator
  - Finally, the fourth chickpea, inside the cotton ball, without being moistened with water.

生命需要一定的温度、光照和湿度。我们来看一个例子：用棉花包裹四颗鹰嘴豆，放在玻璃杯里

- **我们将一颗鹰嘴豆放在浸湿的棉球上（棉球需始终保持湿润），然后将棉球放入一个小玻璃杯中。我们将一颗鹰嘴豆放在浸湿的棉球上（棉球需始终保持湿润），然后将棉球放入一个小玻璃杯中。我们重复此步骤四次，并将它们放入：**
  - **阳光充足的地方**
  - **几乎没有光线的地方**
  - **冰箱里**
  - **最后，第四颗鹰嘴豆，仍然用棉球包裹，但没有用水浸湿。**

Activity 10: Sprouted Chickpeas
活动 10：发芽的鹰嘴豆

After about 10 days, we observe that the chickpeas placed:

- **without water have not germinated**
- **inside the refrigerator have not germinated despite humidity, but the temperature was too low and it lacked light**
- **in the shadows with moistened cotton and very little light have germinated but have a weak and long stem**
- **in the sun with moistened cotton and good temperature have developed vigorously and strongly, although they are shorter than the previous ones**

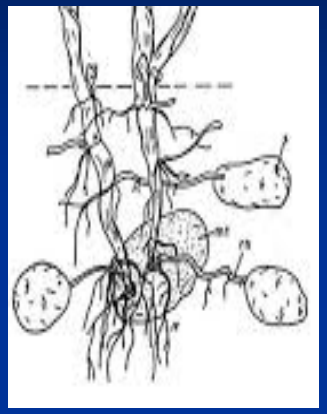
It can be done with different seeds placed in various locations.

大约10天后，我们观察到以下情况：

- 未浇水的鹰嘴豆种子没有发芽
- 放在冰箱里，尽管湿度较高，但温度过低且光照不足，也没有发芽
- 放在阴凉处，覆盖湿棉花，光照较弱，种子发芽了，但茎秆细长而脆弱
- 放在阳光充足、覆盖湿棉花且温度适宜的地方，种子生长旺盛，虽然比之前的种子矮一些。

可以用不同的种子在不同的地方进行测试。

Activity: Sprouted Potatoes
活动：发芽的土豆



We cut the potatoes laterally (to activate them).
We need to find the potato's "navel" (the point where the potato was attached to the plant's root). We place the potato with the navel facing down and cut vertically.
We place a potato (with small sprouts) in a glass of water, but without letting it touch the surface of the water so it doesn't rot. After about 3 or 4 weeks, a strong, long stem will sprout.

我们将土豆横向切开（以激活它们）。
我们需要找到土豆的“脐点”（土豆与植物根部连接的地方）。将土豆脐点朝下放置，然后纵向切开。

我们将土豆（带有小芽）放入一杯水中，但不要让它接触水面，以免腐烂。大约 3 到 4 周后，就会长出一根粗壮的长茎。

Life on exoplanets 系外行星上的生命

The first exoplanet discovered in 1995 is called Dimidio (before 2015 known as 51 Pegasi b), which orbits the star Helvetios, also called 51 Pegasi, a star similar to the Sun, in the constellation Pegasus. It was discovered by Michel Mayor and Didier Queloz.

The conditions for locating Earth-like exoplanets are:

- temperatures that are not too extreme;
- a radius at most two Earth radii; and
- a mass less than about 10 Earth masses

(criteria used by the Kepler mission to search for exoplanets, active between 2009 and 2018, which discovered thousands of exoplanetary systems).

We hope that the James Webb Space Telescope or others will provide data and that we will have some exciting news in the coming years.

1995年发现的第一颗系外行星名为迪米迪奥（Dimidio，2015年之前称为飞马座51b），它围绕着飞马座中的恒星赫尔维提奥斯（Helvetios，也称飞马座51）运行，这颗恒星与太阳类似。迪米迪奥由米歇尔·马约尔（Michel Mayor）和迪迪埃·奎洛兹（Didier Queloz）发现。

寻找类地系外行星的条件是：

- 温度不太极端；
- 半径不超过地球半径的两倍；以及
- 质量小于约10个地球质量。

（这些标准是开普勒太空望远镜在2009年至2018年间用于搜寻系外行星的观测任务所使用的，该任务发现了数千个系外行星系统。）

我们希望詹姆斯·韦伯太空望远镜或其他望远镜能够提供数据，并期待在未来几年里传来令人振奋的消息。

Conclusions
总结

- Know experimentally the dimensions of the planets.
- 通过实验了解行星的直径。
- Establish relationships for a better understanding of the dimensions of the Solar System and the size of the main bodies in it: the Solar System “is empty.”
- 建立并且更好地理解太阳系的大小和其内部主要天体的大小之间的关系：太阳系“是空的”。
- Know the translation and rotation movements of the planets.
- 了解行星的公转和自转运动。
- Know some characteristics of the surfaces of some planets and the Moon
- 了解一些行星和月球表面特征。

Thank you very much
for your attention!
感谢您的关注