

The KETNS Solar System Trail – March 2018

Welcome to the KETNS Solar System Trail.

The Solar System is our home, from where life as we know it evolved. The Sun is at the centre of the system. Around the Sun are eight planets, several dwarf planets, over one hundred moons, millions of asteroids, billions of rocks, icy objects and space... lots of it, all orbiting the Sun and held by its gravity. Light, heat and the Solar Wind stream out from the Sun to the rest of the Solar System. Planets exert their gravitational pull on Moons and other objects. The Solar System travels as a single unit, from the Sun to the smallest speck of space dust and all the space in between on its epic 225 million year orbit around our Galaxy.

There was a time when humans didn't know the shape or size of the Earth or that the Earth was only one of several planets orbiting a huge star. Everybody is familiar with globes of the Earth, however it is more difficult to represent the Solar System to scale. We designed this Solar System Trail over 2km. On this scale 1cm on the trail represents 22,500km in space.

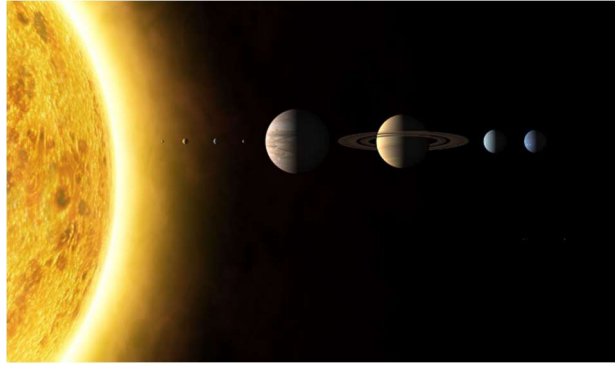
The Scale of the Trail

As you walk the trail, you are walking from the Sun through the orbits of the planets, as if walking out from the centre through the rings of an onion. In reality the planets are never aligned in a line as they are on the trail. The position of each planet represents a point on its orbit around the Sun. For example, the walk from Earth to Mars may seem short on the trail but in reality Mars could be on the other side of the Sun as it makes its 687 day orbit.

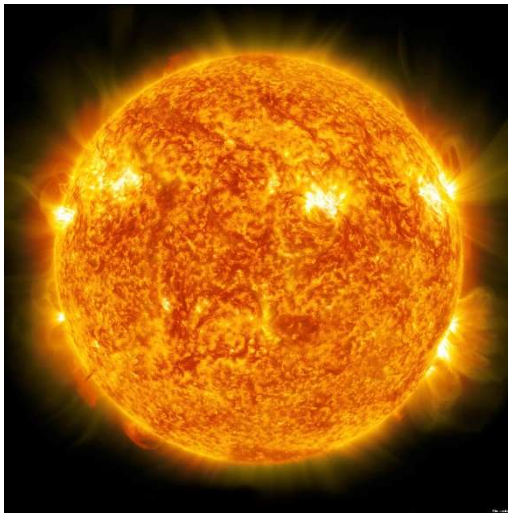
	Diameters of Planets on the Trail	The Actual Diameters in Space	Distance of planets from the Sun on the Trail	Distance of planets from the Sun in Space
Sun	620 Millimetres	1.4 million Km	0	0
Mercury	2.1 Millimetres	4875 Km	26 meters	58 million Km
Venus	5.3 Millimetres	12104 Km	48 meters	108 million Km
Earth	5.6 Millimetres	12756 Km	67 meters	150 million Km
Moon	1.5 Millimetres	3476 km	67 meters	150 million Km
Mars	3 Millimetres	6780 km	101 meters	228 million Km
Jupiter	63 Millimetres	142984 km	346 meters	778 million Km
Saturn	52 Millimetres	120536 Km	635 meters	1433 million Km
Uranus	21 Millimetres	51118 Km	1278 meters	2872 million Km
Neptune	20 Millimetres	49532 Km	2004 meters*	4500 million km

*Neptune is at the same position as Uranus on our trail, for practical reasons.

The Solar System Trail – The Sun and Planets info



The Sun

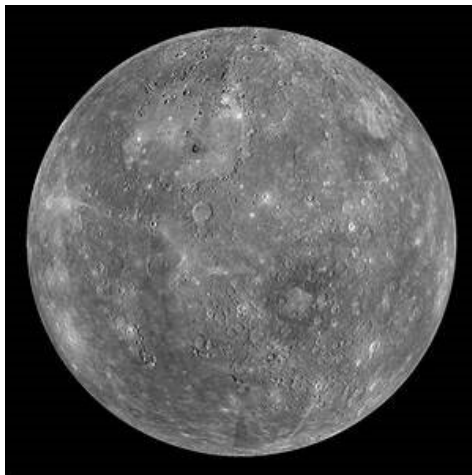


Distance from Earth – 93 million miles (150 million Km)
Surface temperature – 10000 F (5500 C)
Diameter – 865,000 miles (1.4 million Km)
Mass (earth = 1) – 330,000.
Rotation – polar 34 days, equatorial 25 days

The Sun is our local star and dominates everything around it. It looks like a very bright disk but it is a gigantic ball of burning gas, mostly hydrogen and contains 99.8% of all the mass in the Solar System. The Sun has no solid surface. Under immense pressure in its core, atoms of hydrogen fuse together to form atoms of helium in a process called nuclear fusion. During this process energy is released taking over 100,000 years to reach the surface, from where light and heat are emitted into space.

The Sun should never be observed directly with the naked eye or an optical instrument.

Mercury



Distance from Sun – 36 million miles (58 million Km)
Diameter – 3032 miles (4879 km)
Mass (Earth = 1) – 0.055
Rotation period (day) – 58.6 Earth days
Orbital period (year) – 88 Earth days
Axial tilt – 0.01 (symbol for degrees)
Minimum temperature: -290F (-180C)
Maximum temperature: 800F (430C)
Gravity (Earth = 1) – 0.38
Moons – 0

The nearest planet to the sun is also the smallest planet in the Solar System. It is a heavily cratered world with cliffs rising to 1.5 miles (2km) in height. Despite its closeness to the Sun, Mercury's sky is permanently dark as its thin atmosphere does not diffuse light. It rotates very slowly compared to Earth causing the Sun facing side to heat up

and reach scorching temperatures. As it keeps rotating away from the Sun, the heat escapes into space and temperatures plunge dramatically. This hot/cold cycle resulting in the largest contrast in temperature in any planet in the Solar System.

Venus



Distance from Sun – 67.2 million miles (108 million Km)
Diameter – 7520 miles (12104 km)
Mass (Earth = 1) – 0.82
Rotation period (day) – 243 Earth days
Orbital period (year) – 224.78 Earth days
Axial tilt – 2.6
Gravity (Earth = 1) – 0.9
Average temperature: 880F (470C)
Moons – 0

The brightest planet in the sky and similar to Earth in size. It was named after the Roman Goddess of beauty and can be seen in the sky at dusk and dawn. Venus' beauty however is misleading, covered by a carbon dioxide and sulphuric acid cloud up to 55 miles (90 km) thick, it is a yellow inferno with the highest surface temperature of any other planet in the Solar System. Its thick atmosphere weighs down on its surface with a pressure 90 times that of Earth's. Equivalent to the pressure 0.6 miles (1km) deep in the ocean.

Earth



Distance from Sun – 93 million miles (150 million Km)
Diameter – 7918 miles (12742 km)
Rotation period (day) – 24 hours
Orbital period (year) – 365.26 days
Axial tilt – 23.5
Minimum temperature: -128F (-89C)
Maximum temperature: 136F (58C)
Moons – 1

Our home. On it are all the life forms that we know of, from the simplest microbe to a human. It is the only planet we know of to have water as solid, liquid and gas and three quarters of its surface is covered by saltwater oceans. Its crust both oceanic and continental is split into tectonic plates that form a varied topography of mountains and trenches. It's thin blue layer of protective atmosphere shields life from harmful radiation and meteorites. Earth is the only place we know of in which intelligent life has evolved in the Universe.

Moon



Distance from Earth – 239,000 mile (385,000km)
Diameter – 2159 miles (3474 km)
Mass (Earth = 1) – 0.012
Axial tilt – 1.5
Gravity – 0.167
Minimum temperature: -413F (-247C)
Maximum temperature: 248F (120C)

Earth's natural satellite takes 27 days to complete an orbit of our planet, always with the same side facing us. It is a rocky world with much of its surface covered by craters, some over 2 miles (3.2 km) deep. The Moon has a very thin atmosphere that does not diffuse light or retains heat leading to a great difference in temperature between its day and night. It has a much lower gravity than the Earth due to its smaller mass, so on the Moon you would weigh only a sixth of your current weight on Earth. It is the only place beyond the Earth to have been walked on by human.

Mars



Distance from Sun – 141.6 million miles (223 million Km)
Diameter – 4213 miles (6780 km)
Mass (Earth = 1) – 0.11
Rotation period (day) – 24.6 hours
Orbital period (year) – 687 days
Axial tilt – 25.2
Gravity – 0.38
Minimum temperature: -225F (-143C)
Maximum temperature: 95F (35C)

Mars is a cold and barren world, resembling some of the desert regions on Earth. Its red surface is due to iron rich dust that forms into dust clouds 3000ft high (1000m) and sweep over its surface for weeks at a time. It has striking features such as Valles Marineris; a canyon five times deeper and ten times longer than the Grand Canyon and Olympus Mons; the largest volcano in the Solar System. There is water on Mars, frozen in pockets or under the surface in the Poles. In the past Mars had a warmer atmosphere and liquid water on its surface.

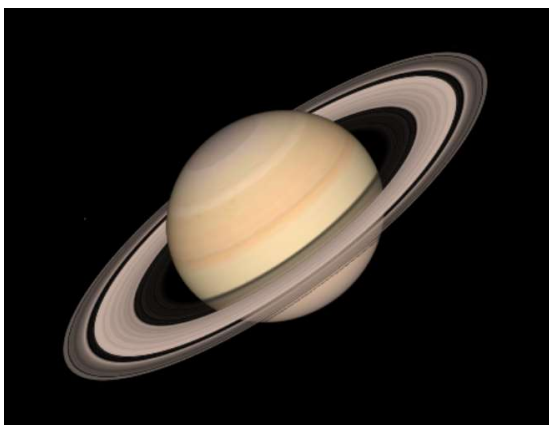
Jupiter



Distance from Sun – 484 million miles (778 million Km)
Diameter – 88,850 miles (143,000 km)
Mass (Earth = 1) – 318
Rotation period (day) – 9.9 hours
Orbital period (year) – 11.86 years
Axial tilt – 3.1
Cloud surface temp: -162F (-108C)
Gravity – 2.36
Moons – 67+

The largest and most massive of the Solar System's planets has no solid surface to land on. Jupiter is a giant ball of gas rotating at 29,000 mph (46,000 km/h). The top layer of cloud creates beautiful bands of swirling shapes and colour. These bands rotate in opposite directions around the planet powered by constant winds that exceed category 5 hurricane speed. A prominent area called the Great Red Spot is a storm that has been raging for over 300 years. Thousands of miles deep into the thick atmosphere the pressure is so intense that hydrogen (the lightest and most abundant substance on the planet) compresses into liquid metal.

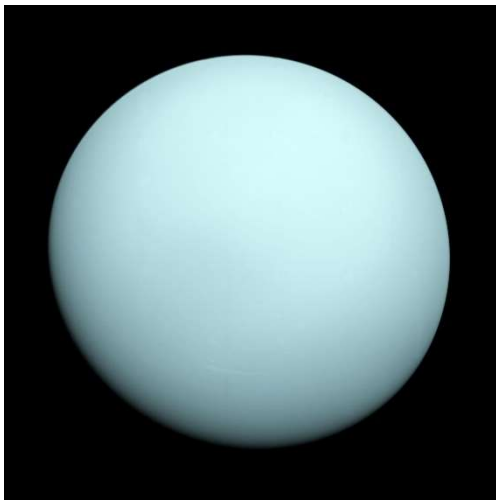
Saturn



Distance from Sun – 888 million miles (1.43 billion Km)
Diameter – 74898 miles (120536 km)
Mass (Earth = 1) – 95.2
Rotation period (day) – 10.66 hours
Orbital period (year) – 29.46 years
Axial tilt – 26.7
Cloud surface temp: -220F (-140C)
Gravity – 1.02
Moons – 62

The furthest planet known of by the ancients, Saturn is the second largest planet in the Solar System. This gas giant spins fast on its axis, generating high winds and electrical storms that last for months. Composed almost entirely of hydrogen, the lightest of the elements, Saturn is the least dense planet in the Solar System and would float on a large enough body of water. The magnificent ring system around the planet is made from billions of ice and rock particles ranging in size from a grain of sugar to the size of a bus.

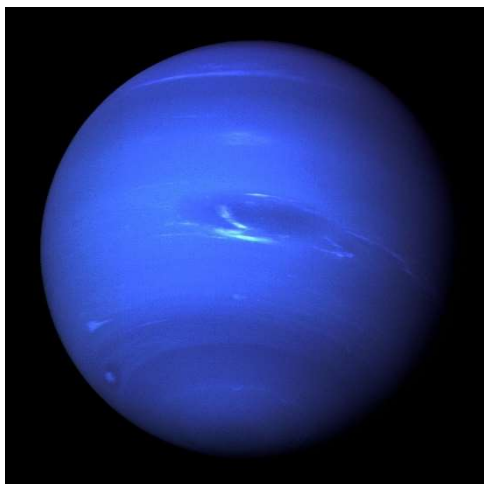
Uranus



Distance from Sun: 1.78 billion miles (2.87 billion Km)
Diameter – 31763 miles (51118 km)
Mass (Earth = 1) – 14.5
Rotation period (day) – 17.2 hours
Orbital period (year) – 84.3 years
Axial tilt – 82.2
Cloud surface temp: -323F (-197C)
Gravity – 0.89
Moons – 27

Tipped on its side, Uranus rolls in its orbit around the Sun rather than spins. Its atmosphere is composed of hydrogen, helium and methane which gives its aquamarine colour. Beneath the atmospheres thick layer of clouds is a 9000 miles (15000km) deep ocean made of water, ammonia and methane ice. Uranus has a system of 13 dark rings made of dust and dark rock. It takes Uranus 84 years to go around the Sun and due to its unique rotation the planets North Pole experiences 21 years of night time in the winter and 21 years of day time in the summer.

Neptune



Distance from Sun – 2.8 billion miles (4.5 billion Km)
Diameter – 30775 miles (49528 km)
Mass (Earth = 1) – 17.1
Rotation period (day) – 16.1 hours
Orbital period (year) – 168.4 years
Axial tilt – 28.3
Cloud surface temp: -330F (-201C)
Gravity – 1.1
Moons – 14

The farthest known planet in the Solar System. Neptune is beyond naked-eye observation and was discovered only in the 19th century. Neptune's vivid blue colour comes partly from the methane in its atmosphere. It has a dynamic weather system and is the windiest planet in the Solar System with ferocious winds of 1,200 mph (2000 km/h), the speed of a fighter jet. The most powerful winds on earth are about 250 mph (400 km/h). Beneath the atmosphere is a deep ocean of water, ammonia and methane ice. Like Uranus, it has a system of faint rings.

Curious points about the Sun and Planets

The Sun

- A day on the Sun (a full rotation) depends on location ... at the Sun's poles a full rotation takes 34 earth days but at its equator only 25 days.
- A Sun year (orbit of the Milky Way Galaxy) is very long ... it takes some 225 million Earth years for the Sun to complete an orbit of the Galaxy.

Mercury

- Can be seen (from Earth) on only a few days each month at dawn or dusk.
- It's year (orbit) lasts 88 earth days and its day (rotation) 59 days.
- It rotates very slowly with day time temperatures reaching 430°C with its night time temperatures dropping to minus -180°C.

Venus

- Slightly smaller than Earth and our closest neighbour.
- Venus has a carbon dioxide atmosphere.
- Although beautiful in the night sky, at a temperature of 460°C, it's the hottest planet in the solar system with large amounts of sulphuric acid on its surface.

The Earth and Moon

- The International Space Station is only 350 Km above the Earth.
- GPS satellites are 20,000 Km away from Earth.
- The Moon, Earth's natural satellite is locked with the same face to Earth some 384,000 Km away.
- As you read this, Earth is orbiting the Sun at 100,000 km per hour, that's 4 times faster than the space shuttle and 100 times faster than a bullet.

Mars

- The length of a day on Mars is 24.6 hours, quite similar to Earth, however its orbit around the Sun takes 689 days, almost twice the length of our year.
- It is a good place to lose weight – due to its weaker gravity, on Mars you will weigh less than 2/5 of your Earthly weight!

Jupiter

- Is the largest planet in our Solar System.
- Jupiter's year is equivalent to nearly 12 Earth Years.
- In 1996 a series of comets slammed into Jupiter, each making a dent the size of the Earth in its atmosphere. Jupiter's gravity attracts space objects and so it has spared the Earth from many possible collisions in the past and is often called our great protector.

Saturn

- Takes almost 30 Earth years to orbit the Sun.
- Although it is 95 times more massive than the Earth, it takes just over 10 hours to complete a rotation, Saturn's day being less than half our day.
- With roughly 20,000 days in its year, birthdays on Saturn would be few and far between.

Uranus

- Spins in retrograde, (the opposite direction of most of the planets). Its axis is tilted at almost a right angle to its orbit.
- Uranus takes 84 years to complete one orbit of the Sun.

Neptune

- The coldest and most distant of the known planets.
- It has 13 moons and a ring system like all the other gas giants.
- It isn't all frozen quiet on Neptune however, wind storms can reach over 2000 Km per hour, in comparison to a category 5 hurricane on Earth, in which winds blow at 250Km an hour.

Where are other large Stars in relation to us in Space and if we could make the trail longer where would those same Stars be on the trail?

Proxima Centauri is the closest star to our Solar System at only 4.2 light years from us. On the trail it would be 18,000 Km from the Sun, heading west from Neptune, the sign for Proxima Centauri would be in New Zealand.

Sirius is 8.6 light years from our Solar System, it's the brightest star in our night sky. On the trail it would be 36,000 Km from the Sun, that's nearly the whole way around the Earth.

The Centre of the Galaxy is 30,000 light years from our solar system. On the trail it would be 116 million Km away from the Sun, to get there the trail would have to be extended from Kilcornan to somewhere in space between Jupiter and Saturn.

Our sun is huge compared to the planets, but how big is it compared to some of the giant stars?



Rigel is a Blue Super Giant Star. It is located in the lower right of the Orion Constellation. Compared to the Sun's diameter of 62 centimetres on the trail Rigel's diameter would be 50 metres wide (80 times the Sun's diameter). If Rigel was our Sun it would extend to an area beyond the orbit of Venus.

Betelgeuse is a Red Super Giant Star, located at the top left corner of the Constellation of Orion. Compared to the Sun's diameter of 62cm on the trail Betelgeuse would be 415 meters in diameter (670 times the Sun's diameter) and extend beyond the orbit of Jupiter.

Thanks!

The Solar System Trail and accompanying written materials were designed and made available by Spacetime Instruments. We develop outdoor educational trails. This project is the first of its kind in County Galway and another first for Educate Together. All the research and work has been carried out voluntarily, any funds raised for the project were used for the actual signs and their installation. The trail encompasses the school and is spread over 1.3km along pathways, through forest and fields in the grounds of Kilcornan, which was generously supported by the Brothers of Charity, Clarinbridge Pharmacy, Clarinbridge Garden Centre and of course the Teachers, Parents and Students of Educate Together.

We hope that this trail will be used and enjoyed for years to come and serve as an inspiration for many to take up the Sciences and explore our Universe ...

Roni Wasserman
Spacetime Instruments

www.solarsystemtrails.com