

December 2019 meeting review by Wendy Knaap

Speaker : - **JAYAGOPAL NAIR**

Subject : - **JUPITER AND THE JUNO PROGRAMME**

Our last - by no means least Presentation to bring the Year 2019 to a close, was given by Jay, who is not only a long standing member of W.A.S. but he also used to be our Chairperson, is currently Treasurer and acting Chairperson. He has spoken to us in the past. Jay is very passionate about Astronomy, being very learned. He gave an exciting lecture accompanied by many Fascinating Images.

At this moment in Time, JUPITER is being Studied Extensively by the JUNO PROBE and gives us some insight into how our Solar System was formed, including our own Planet Earth and the possibility of undisclosed knowledge of The Evolution of LIFE. Science is 'being turned on it's head' by some of the Discoveries and Pictures relayed to Earth. We share this 'JOURNEY OF DISCOVERY' with Jay.

The JUNO PROBE is the 6th Probe to be sent out to TARGET JUPITER specifically. It is named Juno (which in Roman Mythology is the name given to Jupiter's wife!) Previously, 5 NASA / ESA non-Jupiter bound probes were launched... destined to search other parts of The Solar System and indeed beyond the Solar System - yet on their way they passed JUPITER..the GIGANTIC Gas Planet and LARGEST Planet in our Solar System!..

It has very SIMILAR qualities to the SUN - as much as 95.5 % of the composition is the same material as the Sun of which the elements Helium and Hydrogen are part of. It is believed that Jupiter is the 1st PLANET that formed, after the Sun and therefore the OLDEST. This happened more than 4 MILLION YEARS ago! A huge cloud of DUST and GAS collapsed and formed the planets. Jupiter also has a DUSTY ring system which is not easily visible. By size comparison 11 EARTH SIZED Planets could virtually align across the equatorial diameter of Jupiter and it has a RED SPOT full of STORMS - of which 3 Earth Planets would fit in! ..but this red spot is shrinking and it's colour is Deepening. We need to know why this is happening. It also has 79 MOONS presently discovered. - (The Larger the Planet the More Moons it generally has.)

OTHER JUPITER sized Planets have since been discovered at CLOSE proximity to various stars and it is thought that a CATASTROPHIC event might have occurred Millions of Years ago when Jupiter started forming and heading towards the Sun ...Had it not been for SATURN forming from the remains of dust and gases, Jupiter would probably have amalgamated with our Sun at some point and we would NOT EXIST! This explains the GAP between MARS and Jupiter and the ASTEROID BELT.

We now need to know what the FUTURE holds in store for us - concerning our SURVIVAL and so the Juno Probe was launched to carry out INVESTIGATIONS on August 5th 2011 from Cape Canaveral Air Force Station in Florida, loaded to capacity with SCIENTIFIC INSTRUMENTS and a CAMERA on board which have sent back extremely interesting and VALUABLE information about the Planet. It travels up to 3,400 kms above the CLOUD TOPS of Jupiter. It gave us astounding views of The North and South POLES, a feat not possible to be seen from Earth as Jupiter has NO TILT. There is a BIZARRE GEOMETRIC arrangement of STORMS - each arrayed around one CYCLONE over the Poles...unlike any seen in the Universe!

It takes 11.8 years for Jupiter to REVOLVE around the Sun and due to GRAVITY and POWERFUL MAGNETIC Fields it completely ROTATES to form a day equivalent to every 10 Earth hours. The Magnetic Fields can vary over time. There is also a 3rd POLE - an area known as 'The BLUE SPOT' on the equator, where the Magnetism is concentrated and complex and another blue area of Magnetism at it's South Pole! ..yet it is from the CORE of Jupiter that the magnetic fields are actually generated. Further investigations into the Core cannot be made as the PRESSURES are too great lower down. Up to 2 MILLION BARS at the centre of Jupiter would destroy a Probe, but we have some Insight into the Interior by measuring the Magnetic Field.

Jupiter's Magnetic Field is almost 20,000 times MORE POWERFUL than Earth. The RAPID SPINNING of the Planet creates ELECTRICAL CURRENTS in the METALLIC HYDROGEN, (which is about 1/3rd of the way inside the planet and is similar to Liquid Mercury but interestingly,

cannot be created in a Laboratory!) It then generates Electricity that POWERS the Planet's Magnetic Field and results in ELECTROMAGNETIC STORMS. The RED SPOT also goes very deep into the Planet to 100 Bars in depth, which is where HEAT is generated at Thousands of Degrees Centigrade. There are also JET STREAMS - located on either side of the Red Spot.

'DUROCAM' is a camera that only circles Jupiter every 53 days due to the expensive fuel costs. The flypast only lasts 8 hours for safety reasons, due to the INTENSE RADIATION on Jupiter. The rest of the time is spent on sending DATA back to Earth. Juno can see through the Clouds with a '6 channel MICROWAVE RADIOMETER'. It has detected LIGHTNING. This denotes that WATER is present which conducts ELECTRICITY. This Water Ice Cloud Layer lies below the surface of AMMONIA GAS. (The TROPHOSPHERE containing dense clouds of Water influence the Atmospheric dynamics.)

- At a depth of 3,000 kms the ATMOSPHERE is the LARGEST in our Solar System which consists of STREAMS of AIR ... colourful Striped Bands and Zones which ENCOMPASS the Planet. The Bands known as Belts contain gas which descends - and the Zone gas ascends. However, further studies imply that this could be a different situation with the gas from the BELTS ascending and the ZONE gas descending! (Bands that are next to each other have winds that move in OPPOSITE directions.) There are no obstructions in their way, such as continents as we have on Earth - so the Streams continue as IMMENSELY POWERFUL WINDS and can EXCEED 400mph.

DATA recordings have detected 377 LIGHTNING discharges near the Poles. On Earth this occurs in the Tropics on the Equator so this planet behaves in a very different way to ours! It's Orbit is 5 times farther from the Sun than Earth's with 25 times LESS SUNLIGHT than us. It is Jupiter's WARM gases from it's INTERIOR that rise and drive convection which also helps to create lightning. With alternating currents and Magnetic Pull of the Sun's PLASMA ...BEAUTIFUL and BRIGHT POLAR AURORAE are also a sight to be seen! ..

PROBES SENT TO JUPITER

ROCKS THE SIZE OF ALASKA! on the way ..

The 1st PROBES were PIONEER 10 - launched in 1972 , assisted by GRAVITY and after a SUCCESSFUL Mission through the ASTEROID BELT with ROCKS the size of ALASKA travelling at speeds up to 45 K per hr - plus PIONEER 11 which followed on April 5th 1973! Pioneer was the 1st to make direct OBSERVATIONS and obtain CLOSE-UP IMAGES of Jupiter.

STILL SENDING!...

VOYAGER 1 - left Earth on September 1977 and arrived on the 5th March 1979 followed by Voyager 2 on July 9th 1979. The 'SLING-SHOT' manoeuvre using GRAVITY was carried out during a RARE occurrence when 4 planets - including Jupiter, were in CLOSE Alignment, which happens almost 175 yrs. This was carefully PLANNED to enable a group study of the 4 planets and satellites which included Jupiter's LARGEST MOON - 'GANYMEDE' within a short time frame and save on expenditure and fuel at the same time. Voyager is STILL SENDING back DATA so this is NASA'S LONGEST RUNNING MISSION to date!

GALILEO GALILIA

THE GALILEO PROBE named after The FAMOUS Italian ASTRONOMER and PHYSICIST was delivered into Earth's Orbit by Space-Shuttle 'ATLANTIS' in 1989. It was gravity assisted by flybys between Earth and VENUS. It arrived at Jupiter on 7th December 1995. A Magnetic Field was discovered on Ganymede. COMET SHOEMAKER - LEVY 9 IMPACTED on Jupiter at that time and left HUGE SCARS. American Astrophysicist DR. CARL SAGAN set up the 1st ASTROBIOLOGICAL REMOTE SENSING EXPERIMENT for the detection of LIFE from SPACE during the flyby and it came back with very POSITIVE RESULTS! It became a new-born SCIENCE...

PALE BLUE DOT ◦

At this point in the presentation Jay showed us a video with a sound-track of Carl Sagan's Famous Narrative Poem - ' THE PALE BLUE DOT '. This writing was inspired by an IMAGE of The EARTH as seen from Voyager 1 on 14th February 1990. At a distance of 4 BILLION MILES away a CAMERA was turned back towards Earth at Carl's request. It is a truly beautiful and COMPASSIONATE piece of writing about how we should preserve and CHERISH the only home we know ...suspended in a SUN-BEAM...a lonely speck in a VAST Universe.

SWINGING ROUND JUPITER!..

ULYSSES went to Jupiter en route to STUDY the SUN by using Jupiter to SWING round with an 80 % SLING to head for the POLES of The Sun. We watched a demonstration video of this. - Ulysses is now orbiting the Sun between 1-5 Astronomical Units (AU) and orbits every 6 yrs.

CRASH INTO SATURN

CASSINI - HUYGENS .. A Robotic and Advanced Spacecraft (named after Dutch Astronomer/Physicist Christiaan Huygens and French/Italian 17th century Astronomer/Scientist Giovanni Domenico Cassini) was a comprehensive collaboration between NASA, ESA and The Italian Space Agency, launched in 1997 to study SATURN, it's Rings and Moons. During the year. 2000 It spent 6 months STUDYING JUPITER in great detail at a distance of 60 Thousand Miles -which provided us with so much KNOWLEDGE about the Planet with 26,000 IMAGES, including it's faint rings and MOONS. The Spacecraft had been in Space for nearly 20 yrs. before it ENDED IT'S MISSION on Sept.15th 2017 by diving into the atmosphere of Saturn to burn up and PREVENT CONTAMINATION by any Microbes that might be on the Spacecraft.

AFTER-LIFE ON NEW HORIZONS

The NEW HORIZONS Probe named after initials of 'NYX' and 'HYDRA' - (Moons of Pluto) was launched in 2006 and reached Jupiter for a flypast in February 2007. The LORRI CAMERA took Photographs from a distance of 181 MILLION MILES. Research has revealed that bubbles of PLASMA are thought to have formed from material EJECTED from it's MOON IO. IO is VOLCANIC. The Mission was planned to study PLUTO and was gravity assisted from Jupiter to increase the SPEED by almost double in order to reach Pluto. CLYDE TOMBAUGH who discovered Pluto requested that his ashes were carried on the probe to Pluto.

THE MOONS OF JUPITER

There are so MANY MOONS they have not all been named!.. We used to think that Jupiter only had a few Moons when observing through an ordinary Telescope. - There are 79 in total that orbit Jupiter. Galileo and German Astronomer Simon Marius discovered the LARGEST Moons in 1610, known as the GALILEAN MOONS:-

1. IO - the innermost moon that blasts particles into the atmosphere at the rate of 1 TON per second with 400 ACTIVE VOLCANOS affected by Tidal Forces and linked to Aurorae of Jupiter by electric forces. It orbits Jupiter in 42.5 hrs.
2. GANYMEDE - the LARGEST Moon without Atmosphere. Has a Magnetic Field probably due to a LIQUID IRON CORE. Contains SILICATE ROCK and WATER ICE. It orbits Jupiter in just over 7 days.
3. CALLISTO - the 2nd largest Moon and comprises mainly of Rock and Ice, CARBON DIOXIDE, SILICATES and ORGANIC COMPOUNDS. It orbits almost every 17 Earth days.
4. EUROPA - Smaller than our own Moon with a Smooth Surface, possibly ICE with an OCEAN below which may harbour some FORM of LIFE and WATER PLUMES eject from the surface. Only

1 SIDE of the MOON is seen as it is tidally locked to Jupiter. It orbits every 3 and a half days.
One Moon travels in an OPPOSITE direction to the others!

TECHNICALS

We need to distinguish the correct THEORY of PLANET FORMATION - and we need to find out the abundance of WATER on an Interstellar Object in order to determine it's MASS. We need to investigate changes in TEMPERATURE, AURORAE, MAGNETOSPHERE etc; ...and continue with our studies and EXPLORATION. - Juno reached Jupiter on 4th July 2016. Although Jupiter's COMPOSITION is similar to the SUN and also contains HELIUM GAS, the MASS is INSUFFICIENT to Ignite and become a Sun. The bottom of the Atmosphere is equal to 1 BAR... the SAME as found on the Surface of EARTH. Jupiter is a mysterious Planet.. 8 CYCLONES rotate in the same direction on the North Pole and 5 on the South Pole go the same way in the same formation!..(thousands of kilometers in diameter). Juno's Technically Advanced Instruments include 'MICROMONAUS ' to provide us with data feed back with UP-TO-DATE information and Simulations. Powered by SOLAR-ARRAY Juno's Solar Panel generates 400 watts and has a MAGNETOMETER at the end of the Solar Panel. The GRAVITATIONAL PULL can affect the SPEED of the SPACECRAFT and then CHANGES can be measured and the Gravitational Field MAPPED - which will tell us the size and nature of the CORE.

The TOTAL COST of the Mission is \$ 1.1 billion and runs through to 30th July 2021 when it will DE-ORBIT as the FINAL PHASE of the Programme and to avoid contamination - intentionally CRASH into Jupiter. - Due to the Atmospheric Pressure of The Gas Giant it will IGNITE ...and we gain better UNDERSTANDING of how OUR SOLAR SYSTEM works!

- There is an app. called ' NASA'S EYES ' which is a freely available Computerised VISUALISATION app. created at Nasa's Jet Propulsion LABORATORY. It displays Jupiter's Rotation and 'The Jupiter Approach' to manoeuvre into the same orbit as Jupiter as it reveals the WONDERS of this HUGE PLANET..!

3 PASSENGERS ON BOARD THE SPACECRAFT

..Jay ends his Exciting Presentation by telling us about the 3 LEGO CHARACTERS - representing GALILEO, JUNO and JUPITER that were sent out to SPACE...! (Jay's daughter works for Lego) These are very SPECIAL and made of TITANIUM to stand up to RADIATION and PRESSURES they will face ! As Juno CRASHES into Jupiter the 'TRAVELLERS' will be finally CRUSHED by the 10 MILLION BARS!.

Forthcoming meetings

February 19th 2020 William Joyce F.R.A.S. – “The Search for Life in the Solar System”

March 18th 2020 Steve Cross of the Gee-Archaeological Survey – “Pyramids, Temples and Sun Worship in Ancient Egypt”

May 20th 2020 James Fradgley F.R.A.S. – “Goldilocks Planets”, “Lagrange Points” and “The Maunder Minimum”

June 17th 2020 Dr Chris Pearson – “ARIEL and Alien Worlds”

July 15th 2020 David Pulley of the Local Group (Bexhill) – “How do we Know they are all Planets?”