Recordings from the planets and moons of our Solar System

Be prepared to experience a new dimension of our Solar System through the most exciting journey ever undertaken by humankind. The epic space flights of Voyager I & II across our Solar System. This unique series of recordings (5 volumes) is created from original Voyager recordings of the electromagnetic "voices" of the planets and moons in our Solar System. Although space is a virtual vacuum, this does not mean there is no sound in space. Sound does exist as electronic vibrations. The specially designed instruments on board the Voyagers performed special experiments to pick up and record these vibrations, all within the range of human hearing.

In August and September of 1977, two Voyager spacecraft were launched to fly by and explore the great gaseous planets of Jupiter and Saturn. Voyager I, after successful encounters with the two, was sent out of the plane of the ecliptic to investigate interstellar space. Voyager II's charter later came to include not only encounters with Jupiter (July 1979) and Saturn (August 1981), but also appointments with Uranus (January 1986), and Neptune (August 1989). The Voyagers are controlled and their data returned through the Deep Space Network (DSN), a global spacecraft tracking and communications system operated by the Jet Propulsion Laboratory (JPL) for NASA. DSN complexes are located in the Mohave Desert in California; near Madrid, Spain; and near Canberra, Australia.

These recordings come from a variety of different sound environments:

1. From the interaction of the solar wind with the planet's magnetosphere, which releases charged ionic particles within a vibration frequency in an audible range (20 - 20,000 Hz).
2. From the magnetosphere itself.
3. From trapped radio waves bouncing between the planet and the inner surface of its atmosphere.
4. Electromagnetic field noise within space itself.
5. From charged particle interactions of the planet, its moons, and the solar wind.
6. From charged particle emissions from the rings of certain planets.

Spacecraft Review Both Voyager spacecraft have survived in space for fifteen years, and although each has experienced some hardware failures, they are still in robust health and capable of returning valuable scientific data well into the next century.

The Voyagers communicate with earth via their telecommunications systems, which include a 3.65 meter (12-foot) diameter high-gain antenna, a low-gain antenna, an S-band receiver, and X- and S-band transmitters. They can transmit both at S-band (about 2300 MHz) and at X-band (about 8400 MHz) frequencies. (By comparison, typical FM radio transmission is at about 100 MHz, while AM radio transmissions range from about 50 to 160 kilohertz). The X-band frequency has a narrower beamwidth and thus a tighter focus than does the S-band. Each Voyager is powered by three radioisotope thermoelectric generators (RTGs), which produce electrical energy through the conversion of heat generated by the radioactive decay of plutonium-238.

The effects on Voyager's radio signals can help determine the structure and composition of an atmosphere, the size and distribution of particles in rings, and the characteristics of planetary and satellite gravitational fields. Each spacecraft carries instruments for ten scientific investigations, five of which are used in creating these recordings. **Magnetometers:** Each Voyager carries four magnetometers mounted along a 13 meter (43-foot) boom. The magnetometers help characterize planetary magnetic fields, as well as the structure of a magnetosphere and its interactions with planetary moons. Interplanetary magnetic fields are also measured. **Plasma Detectors:** Plasmas are hot ionized gases that flow like liquids and are affected by magnetic fields. Plasmas are often trapped by planetary magnetic fields and interact with planetary satellites and rings. The plasma detector characterizes these interactions and also determines the properties and radial evolution of the solar wind. **Low-Energy Charged Particles Detector (LECP):** The LECP instrument measures the composition and energy spectrum of low-energy charged particles trapped in planetary magnetospheres, as well as the distribution and variation of galactic cosmic rays. **Cosmic Rays:** Cosmic rays are the most energetic particles found in nature and are atomic nuclei (primarily protons) and electrons. Voyager's cosmic ray package uses seven telescopes to analyze cosmic-ray nuclei ranging from hydrogen through iron. **Planetary Radio Astronomy:** Radio emissions from planets are generated by charged particles spiraling along magnetic field lines. Since the magnetic field originates in the interior of a planet, the radio emissions are a good indication of processes within the planet. Radio emissions from the Sun and from lightning in a planet's atmosphere can also be detected. This experiment uses two 10-meter (33-foot) whip antennas to listen for planetary radio emissions over a range from 1.2 kHz to 40.5 MHz. **Plasma Waves:** Plasma waves are low-frequency oscillations in the plasmas in interplanetary space and in planetary magnetospheres.The plasma wave instrument detects and measures plasma wave interactions in planetary magnetospheres and detects interactions between a planetary magnetosphere and the solar wind. It can detect particles in the ring plane and measure their impact rate on the spacecraft.

SYMPHONIES OF THE PLANETS 1

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