THE CASSINI RADIO SCIENCE INVESTIGATIONS

A.J. Kliore (1), R. Ambrosini (2), J.D. Anderson (1), B. Bertotti (3), F.M. Flasar (4), R.G. French (5), L. Iess (8), E.A. Marouf (6), A.F. Nagy (7), and N.J. Rappaport (1). (1) J.P.L., Caltech, (2) Ist. di Radioastronomia, C.N.R., (3) Univ. di Pavia, (4) NASA Goddard S.F.C., (5) Wellesley Coll., (6) San Jose State Univ., (7) S.P.R.L., Univ. of Michigan, (8) Univ. di Roma. Fax: (1) 818 393 4643, E-mail: akliore@jpl.nasa.gov

The Cassini Radio Science investigations will be performed using the most advanced instrumentation both on the spacecraft, now on its way, and on the ground, where the NASA/JPL Deep Space Net receiving stations are being updated with the most stable frequency standards, and a new station at Goldstone, California is being built with Ka-band capability. In addition, a new 64-meter radio astronomy station will be constructed in Sardinia by the Italian C.N.R., which will provide a very important Ka-band capability at European longitudes. The stability of the combined spacecraft/station instrument , which will be 3 parts in 10^{15} over 1000 sec in the coherent mode, will enable Cassini Radio Science investigators to probe the Saturn system with unprecedented precision.

These investigations can be divided into five principal categories. The **Gravitational Wave Search** which will be conducted at times of solar opposition during the cruise from Earth to Saturn, has the objective of searching for long-period gravitational waves crossing the solar system, as well as for an isotropic gravitational wave background. The **Conjunction experiments** , conducted during solar conjunctions during the cruise phase, have the objective of testing the predictions of general relativity to a higher precision than previously possible by measuring the general relativistic time delay and the gravitational bending of the radio path. It is also planned to study the electron density structure in the solar corona and the solar wind near the Sun. The **Gravity Field (Celestial Mechanics)** experiments to be conducted during close fly-bys during the orbital tour phase, have as major objectives of determining the gravity fields of Saturn and Titan, as well as some of the icy satellites, and to measure the tidal deformation of Titan. The **Ring Occultation** experiments, which will be conducted during the tour at times when the spacecraft will be occulted by Saturn's rings, has the objective of determining the ring structure with a resolution ranging from 100 m at Ka-band and X-band to 1 km at S-band, and the particle distribution for particles from 1 cm to 20 m , as well as their variability with longitude, ring opening angle, and time. The **Atmospheric and Ionospheric Occultation** experiments, which will be performed during the tour at times when the spacecraft will be occulted by Saturn or Titan, will have the following objectives: determination of the global temperature-pressure fields, and hence the thermal wind fields, with high vertical resolution from the stratosphere to about the 1-bar level on Saturn, and to the surface on Titan; determination of the ammonia abundance and the He/H_2 ratio in the atmosphere of Saturn down to the level of 1 bar; investigation of the behavior of Saturn's ionosphere with latitude and its interaction with the rings and magnetosphere; and the search for an ionosphere on Titan.