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Measuring electromagnetic waves around Mercury: the wide band search coil magnetometer of the BEPICOLOMBO Mercury Magnetospheric Orbiter

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The Plasma Wave Instrument onboard spacecraft MMO of the BepiColombo ESA-JAXA mission to Mercury is designed for detailed investigations of plasma waves in the planetary magnetosphere as well as in the solar wind close to the planet, especially inside the planetary foreshock. During the two flybys of Mercury in 1974 and 1975 by spacecraft Mariner-10 low frequency waves have been detected by a fluxgate magnetometer inside the magnetosphere and inside the magnetosheath of Mercury. Both the sensitivity and the bandwidth of the magnetometer onboard Mariner 10 did not allow the detection of electromagnetic waves of high frequencies. Theoretical investigations suggest that electromagnetic high frequency waves could be produced in the planetary foreshock and that planetary radio emissions could exist which cannot be observed from the Earth as they are trapped inside the magnetospheric cavity. A wide band search coil magnetometer has thus been designed for providing very sensitive measurements of magnetic field from 100mHz to 640kHz. This wide band search coil magnetometer is part of the Plasma Wave Instrument designed for MMO: its antenna will be parallel to the spin axis of the spacecraft. The low frequency signal will complement the two orthogonal components of the magnetic field measured in the spin plane by low-frequency search coils designed by Kanazawa University; thus full polarisation studies will be possible for the low frequency band from 100mHz to 20kHz. The high frequency part of the electromagnetic spectrum will be measured only through the component of the magnetic field parallel to the spin axis. The scientific objectives and the main characteristics of this wide band search coil will be presented.