ROTATION RATE OF SATURN'S MAGNETIC FIELD. M. K. Dougherty[1], D. J. Southwood[2], M. G. Kivelson[3], C. T. Russell[3], E. J. Smith[4] and M. Burton[4] [1]Imperial College, London, SW7 2AZ, UK, [2]ESA HQ, Paris, France, [3]UCLA, LA, CA 90025, USA, [4]JPL, Pasadena, CA 91109, USA

Introduction: The rotation rate of the interior of a planet is one of its fundamental properties. At Saturn this rate has been difficult to determine. The proxy used at other magnetised planets, the internal magnetic field, was early on revealed to be nearly aligned symmetrically with the rotation axis. The data set recorded by Cassini now much exceeds the Voyager and Pioneer data sets. Cassini observations have clearly revealed non-axisymmetric elements in the field but surprisingly these are from primarily an external source. Moreover the period varies significantly on the timescale of a year just as has been seen in the Saturn kilometric radiation. Many other properties of the Saturn magnetosphere are observed with similar modulations. The polarisation of the periodic magnetic signals in the middle magnetosphere shows that the magnetic perturbations are associated with a rotating field aligned current system located on magnetic shells crossing the equator between 12-15 R_S. The implications of such observations for the identification of not only the origin of observed time-varying rotation rate but also the detection of higher order magnetic field harmonics will be discussed.