Radial variation of the nature of magnetic fluctuations in Saturn's magnetosphere

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In the E-ring plasma torus the magnetic field is generally quiet, with the exception of the almost continual presence of transverse ion cyclotron waves. However, when the field strength drops below about 100 nT near the orbit of Dione, the ion cyclotron waves disappear and compressional mirror mode waves appear. We attribute both waves to mass loading by ion pickup from the E-ring plasma torus with the ion cyclotron waves more unstable at low beta and the mirror mode waves more unstable in the higher beta, more distant magnetosphere. Farther out, the compressional waves are even stronger and the field changes become abrupt and more box-car like. The source of this noise has been interpreted as the interchange mode. It is clear that there are flux tubes of varying plasma beta but it is not as obvious how these flux tubes are heated. Perhaps the heating is associated with the cessation of line-tying in the ionosphere that is believed to occur in this region. Much farther out, where the field strength is close to 10 nT, the plasma no longer is dominated by compressional fluctuations but becomes dominated by transverse fluctuations. This transition of wave types with radial distance varies from pass to pass, both inbound and outbound, signaling a strong temporal variation in the fluctuation level in the saturnian magnetosphere. We explore this variability in the data received to date.