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Jupiter's Synchrotron Emission

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Abstract

The radiation belts of Jupiter were serendipitously discovered after the detection of bursts of Jovian radio emission in the decametric wavelength band by Burke and Franklin in 1955. Following this decametric detection, radio observations of Jupiter became more frequent, and by 1958 observations at a few centimeters measured a black body disk temperature of approximately 150 K, indicative of the temperature of Jupiter's atmosphere near 1 bar. Since their discovery, the inner (<5 RJ) Jovian radiation belts have been routinely monitored by radio telescopes measuring the synchrotron emission emanating from the relativistic electrons trapped close to Jupiter. These observations combined with the relatively few in-situ measurements obtained by spacecraft traversing close to Jupiter have provided a general understanding of Jupiter's inner radiation belts and their variability. As at Earth, Jupiter's radiation belts pose a threat to spacecraft. A review of Jupiter's radiation belts will be presented with an emphasis on the synchrotron emission observations both past and present. Implications for the future exploration of the Jovian system will also be presented.