

Electromagnetic Ion Cyclotron Waves: A Perspective from Past to Present

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Electromagnetic ion cyclotron (EMIC) waves were first observed as geomagnetic field variations on ground amplitude-time paper chart records by Eyvind Sucksdorff in Finland in 1935 as a symmetrical repetitive pattern of a beady string of pearls. Following the IGY and in the 1960s interest in these waves increased when they were observed coherently at middle and high latitudes over distances of 1000 km in both hemispheres. At this time EMIC waves were explained as repetitive discrete wave packets generated in the equatorial middle magnetosphere through wave-particle interaction with 10-100 keV ring current protons, and propagating to the ground along field aligned paths in the magnetosphere. Following extensive satellite observations over the last 20 years it has been shown that EMIC waves play an important role in energy transfer within the magnetosphere. For example, they resonate with MeV electrons and cause electron precipitation loss of radiation belt electrons. This paper will trace the development of our understanding of EMIC wave generation and propagation in the Earth's ionosphere, plasmasphere and magnetosphere, and outline the importance of combined ground-satellite studies in the modern era.