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"Auroras and related phenomena at moons and planets"

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Many distinguished scientists (Halley, Celsius, Birkeland and others) have puzzled over the links between northern lights (more generally, the aurora) and disturbances of the earth's magnetic field. Before the end of his career at the start of the 20th century, Birkeland had elucidated many features of the process through which electrons and ions interact with magnetic fields in near-Earth space to gain energy. They then stream along the magnetic field into the upper atmosphere where they excite particles whose glow we observe from the ground. Today we understand much better the mechanisms that produce aurora on Earth and we have begun to study auroral processes elsewhere in the solar system using telescopes of great resolving power to provide images. With additional in situ spacecraft measurements we attempt to account for the details. Although many features of planetary auroras have parallels on earth, some do not. This talk will consider similarities and differences among auroras and related phenomena observed at earth, Jupiter, Saturn, and the large moons of the latter two. The differing auroral structures arise because there are many different mechanisms for transferring energy from the magnetic field to charged particles but, in every case, the final step in the process excites atmospheric emissions, as Birkeland would have expected.