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Oceanography and Atmospheric Sci. Atmospheric Physics

Creation of Visible Artificial Optical Emissions in the Aurora by High- Power Radio Waves

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Abstract: Generation of artificial light in the sky by means of high-power radio waves interacting with the ionospheric plasma has been envisaged since the early days of radio exploration of the upper atmosphere, with proposed applications ranging from regional night-time street lighting to atmospheric measurements. Weak optical emissions have been produced for decades in such ionospheric "heating" experiments, where they serve as key indicators of electron acceleration, thermal heating, and other effects of incompletely understood wave-particle interactions in the plasma under conditions difficult to replicate in the laboratory. The extremely low intensities produced previously have, however, required sensitive instrumentation for detection, preventing applications beyond scientific research. Here we report observations of radio-induced optical emissions bright enough to be seen by the naked eye, and produced not in the quiet mid-latitude ionosphere, but in the midst of a pulsating natural aurora. This may open the door to visual applications of ionospheric heating technology or provide a way to probe the dynamics of the natural aurora and magnetosphere.

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