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**Experimental Observations of ELF/VLF Wave Generation Using Optimized Beam-Painting**

Abstract:
Observations performed during ELF/VLF wave generation experiments at the High-frequency Active Auroral Research Program (HAARP) observatory in Gakona, Alaska are used to validate a predictive optimization technique. The optimization technique employed is based on experimental observations and is used to identify the location of HF heating as well as the timing and duration of HF heating. As a result, the technique predicts an optimal heating pattern that maximizes the ELF/VLF signal amplitude received on the ground and simultaneously increases the HF-to-ELF/VLF conversion efficiency. Previous work suggested new modulation formats predicted to produce higher ELF/VLF amplitudes and efficiencies. This work presents the first experimental validation of these predictions and determines that an optimized HF beam-painting heating format can produce significantly larger ELF/VLF signal amplitudes with higher HF-to-ELF/VLF conversion efficiency than circle sweep geometric modulation.