

OBSERVATIONS OF BRIGHT HF-INDUCED AIRGLOW IN  
THE PRESENCE OF AURORA

Gerken, E.<sup>1</sup>, Pedersen, T.<sup>2</sup>, Kelley, M.<sup>1</sup>,  
Starks, M.<sup>2</sup>, Mishin, E.<sup>2</sup>

<sup>1</sup>Cornell University, School of Electrical and Computer Engineering, Ithaca, NY 14853

<sup>2</sup>Air Force Research Laboratory, 29 Randolph Road, Hanscom AFB, MA 01731

HF heater-induced artificial airglow observations can be used to diagnose electron energies and distributions in the heated region, illuminate natural and/or artificially-induced ionospheric irregularities, determine ExB plasma drifts, and measure quenching rates by neutral species. At mid-latitudes, in general, only the 630.0 nm oxygen line is bright enough to unambiguously detect with rare cases of detectable 557.7 nm emissions (Bernhardt et al., *J. Geophys. Res.*, **94**, 9071, 1989). However if a sporadic E-layer develops then the heating HF wave is able to interact with a much lower altitude and brighter 557.7 nm emissions ( $\sim 55$  R) are observed as patches (Djuth et al., *Geophys. Res. Lett.*, **26**, 1557, 1999; Kagan et al., *Phys. Rev. Lett.*, **85**, 218, 2000). Unlike the mid-latitudes, the nighttime E-layer at high latitudes is typically created by auroral precipitation and associated with strong ionospheric absorption and bright auroral emissions. In the February 2002 HAARP optical campaign, green line emissions were frequently observed simultaneously with red line emissions but these observations were made in the absence of a strong E-layer and the emissions appear to have been generated in the F-layer. In the March 2004 HAARP optical campaign, however, very bright ( $\sim 4$  kR) green line airglow emissions were observed in kilometer-scale patches between auroral arcs during blanketing E-layer conditions (Pedersen and Gerken, *submitted*). The single most surprising feature of these airglow patches observed in the presence of aurora is their brightness. At  $\sim 4$  kR total intensity, these patches are above the naked eye threshold and are comparable to dim visible aurora. We present our observations of artificial airglow in the presence of aurora and discuss possible generation mechanisms.

Abstract Submission Form  
2004 National Radio Science  
Meeting

Abstract: gerken21604

Date Received: September 22, 2004

1. (a) Elizabeth Gerken  
320 Rhodes Hall  
School of Elec. and Comp. Eng.  
Cornell University  
Ithaca, NY  
14853 USA  
eag48@cornell.edu
- (b) (607)255-2571
- (c) (607)255-6236
2. G - Ionospheric Radio and Propagation
3. (a)
4. C - Contributed Paper,  
Program chair: Paul  
Bernhardt
5. Special Session on  
Ionospheric Modification