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Multi-spacecraft determination of AKR angular beaming pattern along tangent planes

R. Mutel (1), **I. Christopher** (1), T. Jaeger (1) and J. Pickett (1)
(1) University of Iowa (ivar-christopher@uiowa.edu/319-335-1753)

A problem of long-standing interest in auroral physics has been the nature of the angular beaming characteristics of auroral kilometric radiation (AKR). We present compelling evidence, based on Cluster Wideband Data (WBD) multi-spacecraft observations, that the beaming is largely defined by the planar geometry of the density cavities that enclose, or perhaps define, the source region for the AKR. These cavities, field-aligned volumes largely depleted of low-energy electrons, are believed to have widths of order 100 km meridionally, but may extend for thousands of km longitudinally. Pritchett et al. (JGR, 104, A12, 2002) has modelled the AKR generation within such a cavity, and found that the most likely route for the escape of the radiation is longitudinally with significant upward refraction. We have confirmed this prediction by combining AKR location maps using VLBI (Mutel et al., JGR, 108, A11, 2003) with spacecrat locations calculated in 'tangent plane' coordinates. We have analyzed many cases for which we have identified the source location for an AKR event, and, coupled with an analysis of each spacecraft's position relative to the source location, have confirmed that all cases are consistent with radiation escaping from a thin rectangular cavity. Using these results, we have created a model which predicts, for any given spacecraft configuration, the areas within the polar cap where AKR sources could, and could not, be seen from those spacecraft. This has allowed us to statistically analyze the many cases from the Cluster data set wherein AKR was *not* seen. We once again find that the results are consistent with our beaming model. Hence, we find robust observational evidence for AKR beaming in thin ($\sim 5^\circ - 10^\circ$) elongated bundles in the source's tangent plane.