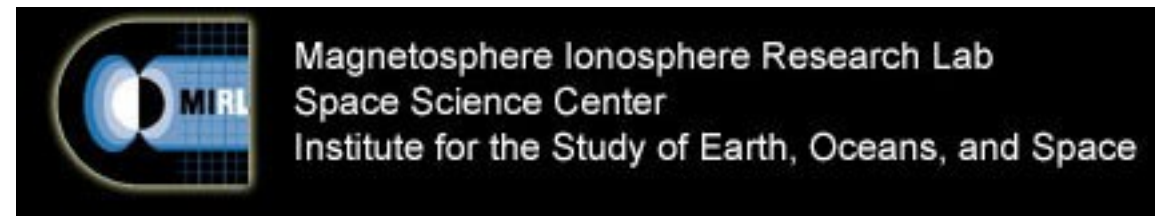




Observation and Classification of Black Pulsating Auroral Features

Matthew Blandin – University of New Hampshire – Physics Department – mjs255@wildcats.unh.edu
Marc Lessard – University of New Hampshire – Physics Department – marc.lessard@unh.edu



What is Black Aurora?

- Noticeably diminished patches within aurora
- The patches have well defined borders
- Types:
 - Worms: elongated diminished patches
 - Arcs: elongated diminished patches curved around an axis of rotation
 - Rings: circular diminished patches with discrete aurora in the center

Noticeable Characteristics

- Black Aurora was observed to occur in one of 3 unique categories
- 1) As a boundary between two discrete aurora patches
 - The discrete aurora would start as one complete patch
 - A black aurora form would 'cut' through the patch dividing it into two
- In some cases the black aurora was completely enclosed by the diffuse aurora



Figure 1: An example of a black auroral form acting as a boundary between two discrete aurora patches viewed on 01/19/07 at 14:09:29 UTC. The white arrows indicate the ends of the event as seen through the camera. It should be noted that due to the form of the event, the length in actuality, extends off the view of the camera. The black arrows indicate the thickness of the black aurora event.

3) As a boundary within a pulsating patch or a boundary between two separate pulsating patches

- When between two separate patches, the black aurora was only noticeable when both patches were turned on, the patches do not need to pulsate with the same frequency
- Only one case of black aurora within a single pulsating patch was observed, in this case, the black auroral form was completely enclosed

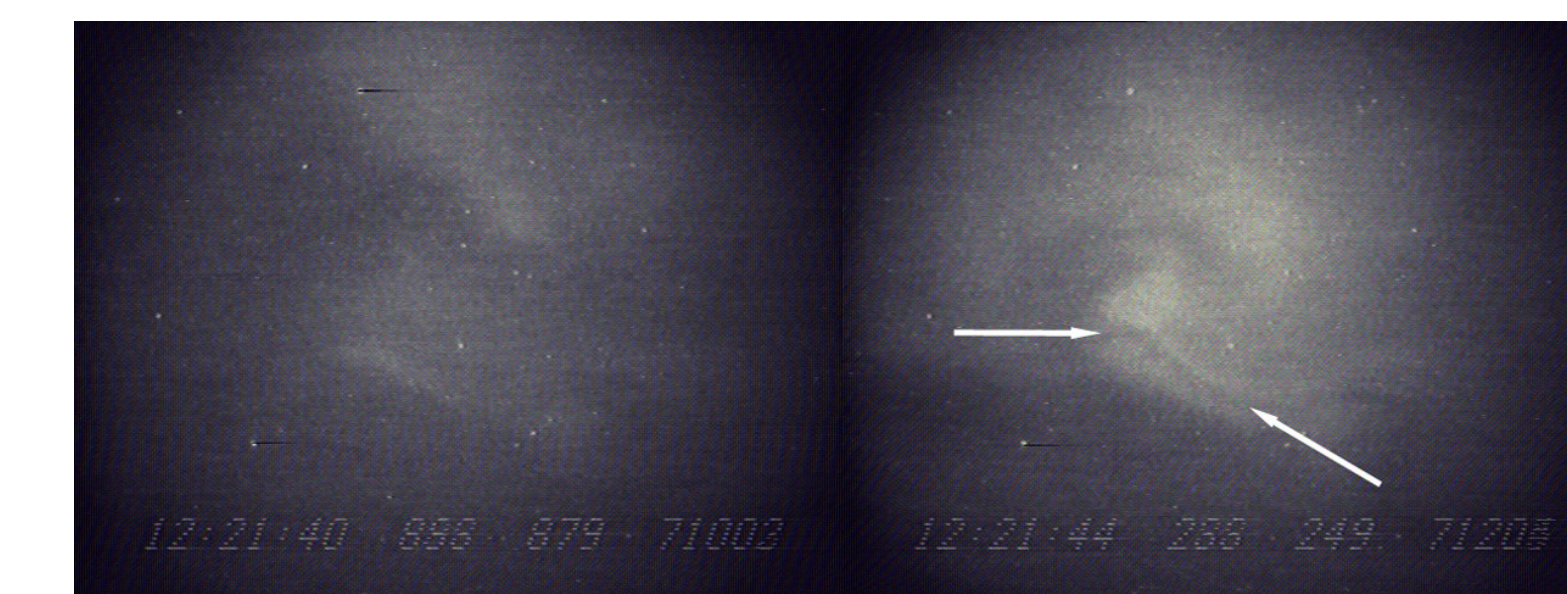


Figure 3: A black auroral form embedded in a pulsating aurora patch viewed on 01/18/07 at 12:21:08 UTC. In the first frame, the patch is off, while in the second frame the patch is on. The white arrows in the second frame designate the ends of the patch.

Instrumentation and Data

- Xybion Electronics System Corporation ISS-750-R3 intensified CCD video camera
- 45.0° x 33.6° field of view lens
- 14.5 hours of aurora footage recorded
 - Jan 18th, 2007 to Feb 12th, 2007
 - 26 black aurora events observed
 - 13 minutes 27 seconds of black aurora
 - Predominately aligned along East – West
 - Average length of 55.4 km and width of 2.4 km
 - Average duration of 31 seconds per event

- 2) As a boundary between discrete and pulsating aurora patches
 - The edge of a discrete aurora patch sets one boundary
 - A pulsating aurora patch will turn on and off, creating the second boundary when the patch was turned on
 - This category is the most unexpected, as pulsating and discrete aurora form in different areas of the atmosphere, showing that the mechanism for black aurora is prominent across both areas

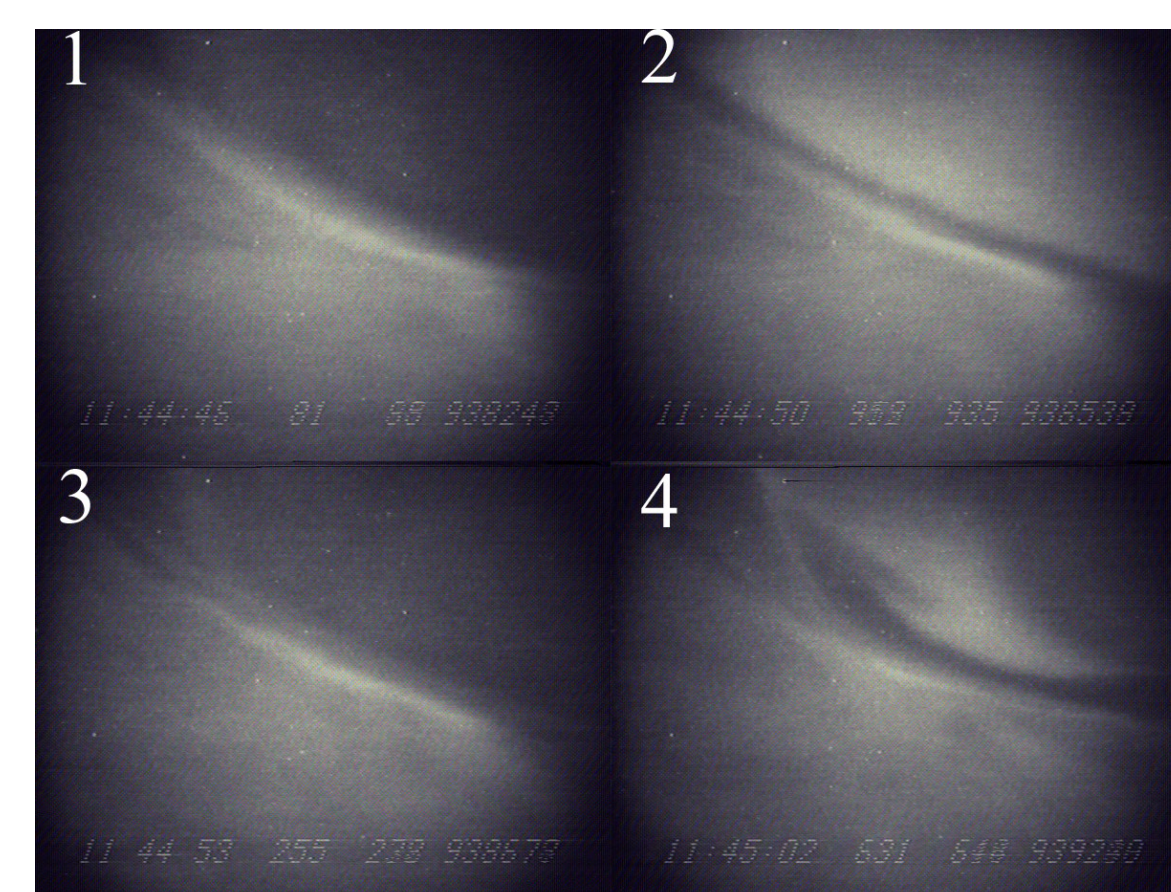


Figure 2: A black auroral form created as the boundary between discrete aurora (bottom of the frames) and a pulsating aurora patch (top of the frame) observed on 01/18/07 at 11:44:35 UTC. In the first frame, the pulsating aurora patch is off. In the second frame the patch has been turned on and the black aurora is visible. In the third frame the patch has turned off again, obscuring the view of the black auroral form. The event is visible again in the fourth frame where the pulsating patch has turned back on.

Persistence

- Within all the observed events, persistence was a key factor
- Persistence for a black auroral form is defined as being observed to keep its structure over the time that it is observed
- Events that are categorized as a boundary between discrete aurora and pulsating aurora, or categorized as a boundary between two separate pulsating aurora patches were observed to show the least persistence
- These cases were subject to the variable intensity between subsequent pulsations
- Events categorized as a boundary between discrete aurora patches and as a boundary within a singular pulsating patch showed the highest persistence, as their forms were not subject to the variable intensity