AurorEye: Production of a Portable, Off-the-Shelf Automated All-Sky Aurora Camera

AurorEye.ca Website

Scan me for more info!

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Why are we doing this?

For decades, the aurora research community has used ground-based all-sky imagers (ASIs) to monitor auroral phenomena and correlate these data with other space and ground instruments. These science instruments are generally fixed in location and capability as part of a network of similar devies. Recently, modern consumer off-the-shelf (COTS) cameras have empowered the aurora chasing community to capture novel auroral phenomena, leveraging their mobility and local knowledge of weather, auroral behavior, and viewing locations. The AurorEye project aims to put flexible, high-resolution, all-sky timelapse cameras in the hands of these aurora chasers.

What's inside?

Hardware

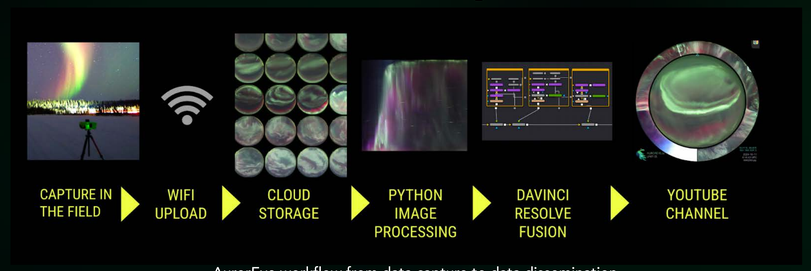
A Raspberry Pi single board computer controls an APS-C 24MP RGB sensor camera with an f/2.0 fisheye lens. Accelerometers, GPS, and a compass allow the unit to be oriented and calibrated. Glove-friendly controls allow the operator to quickly set up, align, and start the AurorEye. Integrated SSD storage and standard lithium ion battery packs allow for hours of capture in cold temperatures. Finally, a WiFi access point allows optional control and monitoring through a smartphone or tablet from a distance. AurorEye is mounted to a standard tripod for quick setup.

Software and Functionality

The AurorEye software operates the camera so that there is minimum black out time between exposures. The project also includes custom software to upload images to the cloud and generate up to 8K timelapses (4000x4000 pixel RGB). On-the-fly software updates can be made to units through remote VNC.

Iterative Design

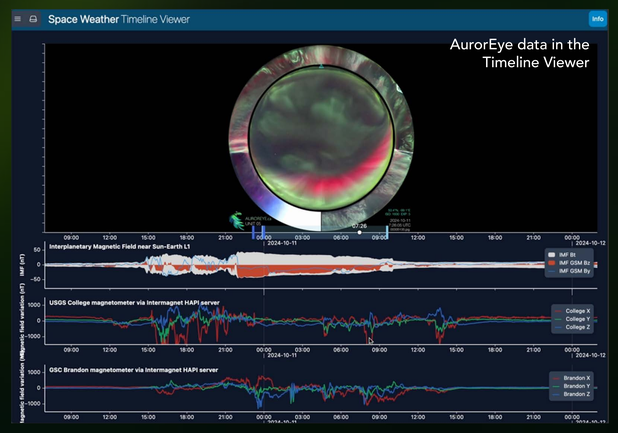
The first AurorEye prototype was deployed in 2021. Since then, the project has undergone software and hardware updates based on feedback from aurora chasers testing it in the field.



AurorEye workflow from data capture to data dissemination

How do we process our data?

We use Davinci Resolve Fusion to generate 4K timelapse videos with overlaid data and a radial keogram visualization suitable for YouTube and YouTube360 VR playback. Fusion's node-based video editing system allows non-programmers to adjust the video parameters and presentation in a familiar video editing environment. AurorEye videos hosted on the dedicated YouTube channel can also be integrated into the KNMI Space Weather Timeline Viewer by Eelco Doornbas, enabling time-synchronized playback with ground and space-based instrument data. Videos are also converted to gifs in order to report to aurorasaurus.org.



KNMI Space Weather Timeline Viewer AurorEye Integration

AurorEye playlist on YouTube

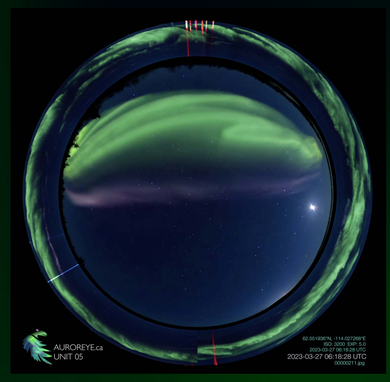
How can you find our data?

All AurorEye images are uploaded to the Capture North YouTube channel. This allows for easy sharing and downloading of quick-look images. AurorEye operators retain appropriate ownership of data they capture. Sharing data on YouTube increases bandwidth and accessibility. YouTube also allows chapters, bookmarks, comments, shareability, clips generation, Immersive VR, and embedding metadata (for example to work with the space weather timeline viewer).

What have we seen?

Quiet-time STEVE

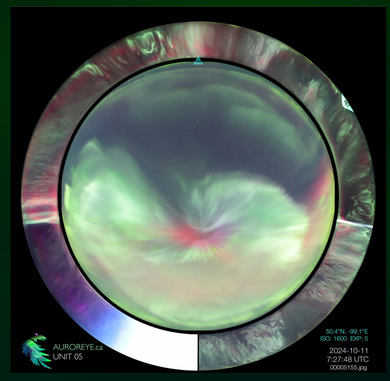
On March 27, 2023, AurorEye unit 05 operated by Jeremy Kuzub captured a quiet-time STEVE event in Yellowknife, Canada. More info in Gallardo-Lacourt et al., (2024) doi: 10.1029/2024GL110568.



STEVE appears as a white/purple arc equatorward (below) the main auroral oval.

Big Events

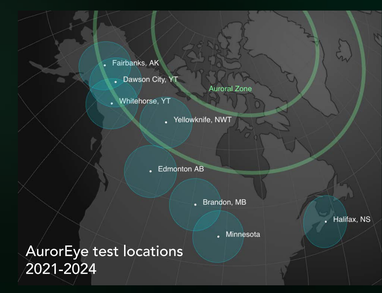
AurorEye units were deployed for the May 10 and Oct. 10, 2024 storms. These optical aurora data may be crucial for scientific analysis of these events. For example, during these times since the auroral oval was equatorward of many science-grade ASIs (e.g, TREx and THEMIS).



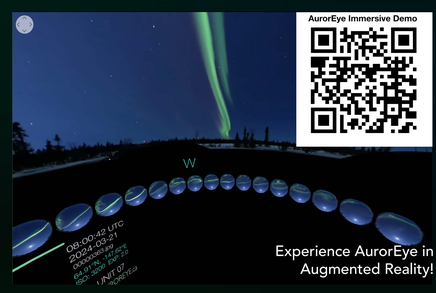
Corona aurora on October 10, 2024 captured on UNIT 05 operated by Donna Lach in Plumas, Manitoba

Have a smartphone?

Scan the QR code below to view a night of aurora captured with the AurorEye in Augmented Reality!



AurorEye test locations 2021-2024



Experience AurorEye in Augmented Reality!

What's next?

AurorEye may be deployed in response to citizen science campaigns and during geomagnetic storms. A smaller low-cost version for fixed locations (AurorEye mini) with aurora detection is in development. More units are being built based on user feedback and as new camera gear is released. AurorEye data are available on the YouTube channel, and researchers and students can request data for their projects. We are open to collaboration!