Astronomy at Eureka on Ellesmere Island

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National Research Council Canada

SCAR Astronomy and Astrophysics from Antarctica
Siena, Italy

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Matthias Schoeck, Tony Travouillon (Thirty Meter Telescope)
Ming-Tang Chen, Pierre Martin-Cocher (Academia Sinica Institute of Astronomy and Astrophysics)
William Ward, Tony Xie (University of New Brunswick)
Liviu Ivanescu, Rene Racine (Universite de Montreal)
British Empire Range
Yelverton Bay, Ellesmere Island
82N, 2616 m highest elevation

Site 11A 1098 m
Site 14A 1639 m
1868 m
1800 m
1720 m
1402 m
1300 m
Camp
Automated Meteorological Station and Horizon-Viewing Camera (Inuksuk) 2006-2010
All-Sky Camera and Polaris Tracker (Ukpik)
2007-2010

National Research Council of Canada

Steinbring et al., 2012, SPIE
Polar Environment Atmospheric Research Laboratory (PEARL)
Eureka, Ellesmere Island
80N, 600 m elevation

Environment Canada / Canadian Network for the Detection of Atmospheric Change
Approaching 60 years of continuous meteorological records at Eureka

Stand-alone 7-m tower for MASS/DIMM telescope 2014

DIMM telescope 225 GHz radiometer Sky-brightness monitors 2011

SODAR turbulence profilers 2009-2012

All-sky camera 2007-2011
ATP lunar scintillometer 2009-2011
MASS/DIMM telescope 2012
0.5-m planet-finding telescope 2013

Twice-daily weather balloons launched from sea level

Robotic 1-4 m class AO telescope in LRP as per Racine High-Resolution Telescope

Recommendation 19 Site testing at PEARL should be funded and continued until the image quality at the site can be fully characterized. This site testing requires continued support of the PEARL facility. In addition, testing should be extended to at least one additional, preferably higher altitude, site in the High Arctic. If the superlative image quality of Arctic sites is confirmed, then the LRPP recommends a design study and the development of a science case for a small (1-4 metre) telescope, and technical studies on telescope construction and operation in polar environments. This would be followed by telescope construction.
PEARL All-Sky Camera (PASI)  
2007-2011  
University of New Brunswick
Detection of 3.97-Day Period of Polaris Using PASI

Steinbring, Ward, & Drummond, 2012, PASP
Atmospheric Transparency from PASI Data

Skies at PEARL are usable 84% of time, clear 68% of time, can be continuously so for 100 hours or more; truly photometric 48% of time, and better from higher terrain

Steinbring, Ward, & Drummond, 2012, PASP
J-Band Sky-Brightness Monitor Measurements
2011, 2012/13

J-band sky brightness
15 mag/square-arcsec

Sivanandam et al., 2012, SPIE
225 GHz Tipping Radiometer
2011

Academia Sinica Institute of Astronomy and Astrophysics
Opacity measurements with 225 GHz tipping radiometer

Median winter Tau of 0.10 agrees with low PWV, expectations from models

Asada et al., 2012, SPIE
Chen et al., 2013, IAU
Arctic Turbulence Profiler (ATP)
2009-2011

University of British Columbia
Median boundary-layer seeing is 0.57 arcsec at 20 m elevation, and assuming 0.30 arcsec free seeing yields total of 0.68 arcsec; best quartile: 0.42 arcsec
DIMM and MASS/DIMM Telescopes
2011, 2012
MASS/DIMM V-band seeing is 0.76 arcsec or better at 8-m elevation; best 20 percentile 0.54 arcsec with typically 0.30 arcsec from free atmosphere - in agreement with ATP.

Steinbring et al., 2013, PASP
10-inch DIMM “Adaptive Optics” Imaging

A - B = 18.2 arcsec
Aa – Ab = 0.18 arcsec

Figure 1. Co-added ACS HRC images of Polaris Aa, Ab taken with the F220W filter on 2005 August 2 (left) and 2006 August 13 (middle). The close companion Ab is detected at the lower left of the primary (at about a “7 o’clock” position). The images are 0.085 x 0.085 and the directions of north and east are indicated. The right-hand panel shows a co-added image of Polaris B from longer exposures taken during the 2006 observations, and scaled to the flux level of the Polaris Aa, Ab images. There is no artifact in the Polaris B PSF at the location of Ab.
Arctic Wide-Field Cameras (AWCams) 2011-2013

University of Toronto

Millimag photometry demonstrated over clear periods lasting days

Law et al., 2012, AJ
Slope Detection and Ranging (SLODAR)
2012

Dunlap Institute of Astronomy and Astrophysics
PI: Jerome Maire

Altitude – 600m
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