Passive Optics activities in Japan

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¹NICT, ²Nagoya Univ., ³NIPR, ⁴Tohoku Univ., ⁵Niigata Univ., ⁶Kyoto Univ.
## Instrument for passive optical measurements

<table>
<thead>
<tr>
<th>Institute</th>
<th>FPI</th>
<th>ASI</th>
<th>Photometer</th>
<th>Others</th>
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</thead>
<tbody>
<tr>
<td>Tohoku Univ.</td>
<td>Zao(D)</td>
<td>Campaign base (for obs. Sprite)</td>
<td>Campaign base(Multi-anode array x 2)</td>
<td>Image-intensifies CCD Camera (2 sets), Watec CCD Camera (up to 40 sets collaborating with high schools)</td>
</tr>
<tr>
<td>NIPR</td>
<td>Syowa(D)</td>
<td>Syowa(ASI, ASC, ATV) South Pole (ASI)</td>
<td></td>
<td>Longyearbyen (Aurora Spectrograph Meridian Spectral Image)</td>
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<tr>
<td>NICT</td>
<td>Eagle(D)</td>
<td>PFRR(ASI x 2)</td>
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<td>PFRR (Aurora Web Camera)</td>
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<td>Niigata Univ.</td>
<td></td>
<td></td>
<td>Campaign base( Scanning)</td>
<td>Campaign Base(Filtered CCD, monochiromatic CCD)</td>
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<tr>
<td>Nagoya Univ.</td>
<td>Shigaraki (D =&gt;S)</td>
<td>Shigaraki Sata Rikubetu Darwin Koto Tabang</td>
<td>Shigaraki(Tilt) Sata (Temp) Rikubetsu(Tilt x 2, Temp x 1) Koto Tabang (Temp)</td>
<td>Shigaraki(SATI: Spectral Airglow Temperature Imager)</td>
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<tr>
<td>Kyoto Univ.</td>
<td></td>
<td>Indonesia Colorado Misato</td>
<td></td>
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</tbody>
</table>

D: Doppler Imaging, S: Steerable Narrow Field of FPI
Fabry-Perot Doppler Imaging System (Tohoku Univ.)

All-sky Fabry-Perot Imager

Location: Zao Observatory (38.1N, 140.6E)
Year: 1994 - 1998 (routine)
1998 – present (campaign)
Target: AGWs and Tides

Campaign observations at Syowa Station, Antarctica (69.0S, 39.6E) in 1990, 1994, 1996 for studies of auroral thermospheric dynamics
Zao FPDIS (OI 558 nm) 1996 Oct. 11

Relationship between neutral mean flow and atmospheric gravity waves in the mid-latitude $E$-region.

Syowa FPDIS (OI 630 nm) 1996 May 13

Relationship between neutral winds and ion drifts in the auroral $F$-region. Neutral winds were suggested to be driven by ion drag force [Sakano et al., 2002, JGR].
NICT-FPI
(National Institute of Information and Communications Technology)

FOV=1.4deg

Etalon: $\phi=116\text{mm}$
$d=20.49\text{mm}$

filters: 557.7nm/630.0nm
NICT All-Sky Imagers at Poker Flat, Alaska

Observatory:
Poker Flat Research Range (PFRR)
65.1°N, 147.5°W, MLAT65.5°

Observation Periods:
Nov., 2001 ~ Mar., 2002
Sept., 2002 ~ Mar., 2003
Sept., 2003 ~ Mar., 2004

Wavelength:
CRL-ASIs can observe up to ten kinds of aurora and airglow emissions.
Examples of Observational Results

27 October, 2000, Poker Flat Research Range (65.1N, 147.5W)

“Evening Co-rotating Patch aurora”

→ False color all-sky images made by OI 557.7-nm and 630.0-nm images taken every 20 minutes. Patch-shaped auroras spread over the sky can be seen. Motion of the patches was very slow. In particular, they maintained their shapes and positions from 03:20 to 04:00 UT.

Kubota et al., GRL., 2003.

Gravity Wave Propagations
Optical Mesosphere Thermosphere Imagers (OMTIs)

- Sata ('00 06-)
  - Imager #2
  - Temperature photometer

- Rikubetsu ('98 10-)
  - Imager #3
  - Tilting photometer #2
  - Temperature photometer #3

- Shigaraki ('98 10-)
  - Imager #1
  - FPI
  - SATI
  - Tilting photometer #1

- Koto Tabang ('02 10-)
  - Imager #5
  - Temperature photometer #1

- Darwin ('01 10-)
  - Imager #4

Mag. Equator

STE Lab.
Nagoya Univ.

http://stdb2.stelab.nagoya-u.ac.jp/omti/index.html
Optical Auroral Observation by NIPR

Arctic Regions

(Svalbard area)

B-3,4

A-1,4,8,9

U-2,4,6,7

CA-1

O-3

A-2

U-1

O-1,3,4,9

A-6

U-10

B-4

Gl-3

O-2

Longyearbyen

(16.3E, 78.2N)

Aurora Spectrograph (ASG)
Meridian Spectral Image
FOV 180°, 420-730nm
Period: 2000～
PI: Takehiko Aso (aso@nipr.ac.jp)
Antarctic Regions

South Pole
(-, 90.0S, 2835m)

- Fabry-Perot Imager (FPI)
  Wide-Angle (150°) Image
  OI 557.7, OI 630.0
  Period: 2001～
  PI: Makoto Taguchi
  (taguchi@nipr.ac.jp)

- All-Sky Imager (ASI)
  All-Sky Monochromatic Image
  OI 557.7, OI 630.0, N2 + 427.8,
  NaD 589, H β, OH(8-3)
  Period: 1998～
  PI: Makoto Taguchi
  (taguchi@nipr.ac.jp)

- All-Sky Imager (ASI)
  All-Sky Monochromatic Image
  OI 557.7, OI 630.0, N2 + 427.8,
  NaD 589, H β, OH(8-3)
  Period: 1998～
  PI: Makoto Taguchi
  (taguchi@nipr.ac.jp)

- All-Sky Camera (ASC)
  All-Sky Panchromatic Image
  Period: 1970～1997 (Film)
  1998～2002 (Digital)
  PI: Makoto Taguchi
  (taguchi@nipr.ac.jp)

- All-Sky TV Camera (ATV)
  All-Sky Panchromatic Video
  Period: 1986～
  PI: Natsuo Sato
  (nsato@nipr.ac.jp)
Airglow Imaging Observation by RISH, Kyoto Univ. (former RASC)

RISH: Research Institute for Sustainable Humanosphere

• Misato, Japan (34.14N, 135.41E)
  All-sky, OH, OI(557.7), Na
  Dual-site observation with Shigaraki (34.85N, 136.10E)

• Yucca Ridge, CO, USA (40.7N, 104.9W)
  All-sky, OH
  Dual-site observation with Platteville (40.2N, 104.7W)

• Tanjungsari, West Jawa, Indonesia (6.9S, 107.9E)
  Wide Field, OH
  Gravity waves over deep convection

PI: Takuji Nakamura (nakamura@rish.kyoto-u.ac.jp)/Kyoto Univ.
Dual site airglow imaging observation

Estimated height of airglow image structure (nighttime average)

Misato – Shigaraki, 2000-2001
(Kyoto U.– Nagoya U.)
FRONT-3 campaign
F-region Radio and Optical measurement of Nighttime TID
May-June 2003

Observations of Medium-Scale Traveling Ionospheric Disturbances in the geomagnetically conjugate regions of Japan and Australia by Nagoya University, Kyoto University, NICT and IPS.

Japan
   Imager: Rikubetsu, Shigaraki, Misato, Nishiharima, Sata
   Radio observation: GPS array, MU radar, Ionosondes

Australia
   Imager: Darwin, Renner Springs
   Radio observation: GPS scintillation (Renner Springs)
3-m scale field-aligned irregularities observed by the MU radar at Shigaraki

630nm-band airglow at Shigaraki and Renner Springs [Shiokawa et al., 2004]

Total Electron Content observed by GEONET