Canadian OIR astronomy: Surveying the present and praying for the future

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NRC Herzberg

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Canadian Radio Astronomy: Surveying the present and planning the future
A Technical Network

SPIOMM → SITELLE → PUEO → ALTAIR → NFIRAOS → GIRMOS → IRMOS

A Science Network

Wide field imaging
PRV
Polarimetry

Narrow field spectroscopy
Exoplanet imaging/spectroscopy
Deep imaging

A Set of Partnerships

Strong voice and leadership role in key collaborations
Ambitious set of collaborators with shared interests
The LRPP recommends continuing funding from NRC and NSERC for the productive small telescopes discussed above, with an emphasis on increasing remote access/queue mode observing to serve the widest possible community.

The MTRP re-iterates the need for continued funding of productive Canadian small telescopes.

Canada should continue to be a major partner in CFHT, and should support and participate in new instrumentation projects (specifically, Imaka, SPIROU, and GYES). These instruments should have a five year operations window prior to any anticipated redevelopment of the CFHT site.

The LRPP recommends that Canada develop the ngCFHT concept (science case, technical design, partnerships, timing).

The MTRP strongly recommends that Canada develop the MSE project, and supports the efforts of the project office to seek financial commitments from Canadian and partner institute sources.

The LRPP recommends that Canada's participation in Gemini be reconsidered as we reach the point that Canada's VLOT project requires operating funds. Timely access to a VLOT remains Canada's number one priority for large projects in ground-based optical-infrared astronomy.

The MTRP recommends that Canada's participation in Gemini continue to be supported beyond the end of the 2016-21 International Agreement. The nature and level of that participation must be considered within the context of a coordinated plan for funding the operation of our ground-based facilities, together with any new opportunities for broader access to the landscape of 8-10m optical/IR telescopes.

If by early 2012 it appears that a 2014 construction start for TMT will not be feasible, then the LRPP recommends that we take steps to become a partner in the E-ELT project by joining ESO, and that we discontinue our participation in TMT. The continued participation of HIA is essential to maintain Canadian presence in the TMT project.

With access to a VLOT being the number one priority for ground-based optical-infrared astronomy, the MTRP reaffirms the importance of maintaining a "second-to-none" share in TMT. Since partner shares will also factor in future contributions to the observatory, the MTRP therefore strongly endorses ongoing development of second-generation Instrument concepts and encourages the various teams to pursue funding.
• General purpose super-sensitive mega facility; early light instruments already identified; second generation discussions starting

• TMT science team meeting in India in November; ACURA support available to Canadians (see email from CATAC Chair, Michael Balogh, sent of CASCA exploder on Monday)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>λ (μm)</th>
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<tbody>
<tr>
<td>InfraRed Imager and Spectrometer (IRIS)</td>
<td>0.8-2</td>
</tr>
<tr>
<td>Wide-field Optical spectrometer and imager (WFOS)</td>
<td>0.3-0.8</td>
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TMT

• Well publicized, serious issues relating to TMT and all Maunakea astronomy, and their relationship with Hawaii, especially but not only with the indigenous population.

• Very belated but very welcome improvements in activities of all the observatories to involve the Hawaii community in the life and operations of the telescopes.

• Simultaneously, the legal process has been proceeding in the full light of day

• Net result is a good level of public support for astronomy/TMT in Hawaii and on the Big Island

• Current legal situation appears to (cautiously) favour TMT construction eventually restarting in Hawaii

• Cost overruns probably now the major stress for Board members. CATAC telecon on September 26 @ 3.30EST
Gemini

Workhorse 8m OIR facility for Canada; access to both hemispheres

Recent surge in new instrumentation:

- Flamingos 2 (IR spectrograph system, G-S)
- GeMS/GSAOI (MCAO system with high resolution imager, G-S)
- GPI (high contrast imager, extreme AO, G-S); moving to North after potential upgrades
- GRACES (high resolution optical spectroscopy, G-N); fiber feed to Espadons at CFHT)
- GHOST (2019, G-S); (high resolution optical spectrograph)
- OCTOCAM (~2022, G-S); Broad-band moderate resolution spectrograph and multi-channel imager
- GIRMOS; IRMOS pathfinder for G-S, lead by UToronto/Dunlap. Technically a visitor instrument, but facility-class (multi-object IFU using GeMS)

Canada ~18% partner (2nd after US, who hold >50%)
Common perception that Canada lacks of influence in governance; plus overly complex governance structure
**Massive** dependence of Gemini on Canadian instrumentation development
Gemini

• Gemini-S and Gemini-N might be allowed to follow different evolutions in the future
  • Big push in US to make Gemini-South into a spectroscopic follow-up facility for LSST
  • Unclear to me if there is a an official plan for Gemini-N
  • My plan: Gemini-N should be viewed as a feeder/test-bed for TMT science/instrumentation
    (one of the best NIR optimized telescopes on the planet, sharing a site with TMT)

• Gemini - LSST - NOAO operations are currently being integrated into new organization called NCOA (National Centre for Optical Astronomy).
  • Idea is based around a shared-services approach for astronomy operations
  • Aiming for completion in 2018 (?)

• Partnership agreement runs until the end of 2021.
  • In 2018, current partners are supposed to indicate their willingness or otherwise to continue as members post-2021
  • Some rumours that future agreements might be more flexible than current arrangement (e.g., different access deals to Gemini-N or Gemini-S)

• Canada should use this opportunity to plan for the future with respect to mid-sized telescopes
CFHT

• Every Canadian’s favourite 4m telescope; governance is simple (TMT is copying their model of being a 501(c)(3) non-profit corporation)

• Queue-based observing. Four instruments with fifth pending:
  • MegaCam (optical wide field imager)
  • WIRCAM (NIR wide field imager)
  • Espandons (optical high resolution spectropolarimeter)
  • SITELLE (Wide field Fourier Transform Spectrograph)
  • SPIROU (NIR high resolution spectropolarimeter) [for delivery 2018]

• Still an on-going discussion as to whether CFHT could take over UKIRT operations
  • reduce pressure on CFHT observing time caused by advent of SPIROU
  • ease the politics of redevelopment of CFHT (see later) since will be a period of ~4 years while CFHT/MSE is not available for observing

• CFHT is work-horse facility for wide field imaging in particular; prior to advent of Subaru HSC, best wide field imager on a large telescope (and still the only one with significant u-band sensitivity)
The global effort in wide field imaging
(slide courtesy of J. Cuillandre)
Canada-France Imaging Survey (CFIS, S17A - 19B, 271 nights)

- 10000 square degrees of u-band, declination>0; u~23.6, SNR=10
- 5000 square degrees of r-band, declination>30; r~24.1, SNR=10
- >100 collaborators, ~40 Canadians; all Canadians welcome, email me!
Current Canadian wide field OIR opportunities

- CFIS will provide some data to Euclid for their northern photo-z needs (~20 seats on Euclid for Canadians as a result)
- We can leverage this opportunity further…
New Canadian wide field OIR opportunities: LSST

• The major OIR priority (major ground based astronomy priority) for the US; responsible for shaping many of the future priorities of the US community (e.g., Gemini-S instrumentation; wide field MOS etc)

• Dunlap Institute (B. Gaensler) and UBC (L. van Waerbeke) leading Canadian LSST Consortium

• LSST membership ~USD20K/person/yr. DI providing 50% of costs for 10 Canadians; others can buy in at full rate

• Kicks in 2021

• **Not Canadian national access**

• LSST will eventually release many of its data products to the world, but my understanding is that it will not release the raw data or images to the world
Subaru’s operating budget in the era of TMT is approximately USD0.

Japan is looking for international collaborators to share operating costs (Australia; potentially Republic of Korea, Taiwan and China, possibly through EAO).

Couple of meetings over the last 4 years with significant Canadian involvement, based around future instrumentation opportunities (especially, GLAO). Also tour of Canadian universities by Ikuru Iwata in 2016.

- **GLAO: Sapporo, June 12 - 14, 2013 (AWM, Simard, Venn, Balogh, Marcin Sawicki)**
- **Int. Collaboration: Mitaka, March 22 - 24 2017 (P.Cote, Crabtree, Ferrarese, Metchev, Sawicki, AWM)**

Again, timing is good in terms of coinciding with Gemini renewal. Japan is already a collaborator of Canada through the TMT and significant investor in Maunakea.
New Canadian wide field OIR opportunities: MSE

- MSE is a redevelopment of CFHT, by replacing the existing 3.6m telescope facility.

- 11.4m segmented mirror telescope equipped with a dedicated wide-field highly multiplexed fiber-fed spectroscopic facility, operating at low, medium and high resolution at optical/NIR wavelengths.

- A survey facility with a small amount of regular PI time (80/20 split). Regular calls for Large Programs (think ESO Public Surveys).

- Began life as ngCFHT, a grassroots effort in Canada in 2010 stimulated by the LRP exercise.

- Considerable progress since establishment of Project Office in 2014, leading to fully costed Conceptual Design Documents by end of 2017.

- MOU in development to take MSE through Preliminary Design Phase.

- US, ESO starting to consider their own versions, and looking for opportunities for international collaboration.
Summary

• TMT is the critical aspect of the OIR plan, to the extent that such a plan actually exists

• Recognized that we need 4/10m class support facilities, including survey facilities to complement pointed facilities

• Given TMT focus on Maunakea, implies we should direct resources to that set of telescopes (equatorial setting is very good; 3/4 of entire sky is visible at airmass<1.5

• Gemini renewal offers potential opportunity for Canada to get its act together regarding these other facilities

• Any real astronomy network is not confined in bandpass