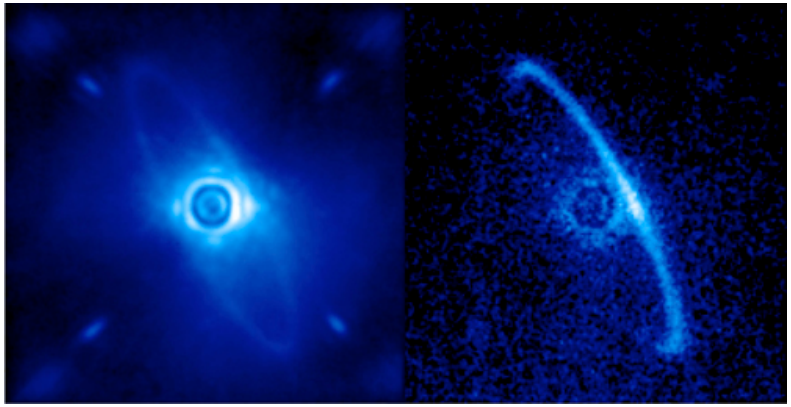
Canadian Users

• 590 members of CASCA (including students and postdocs)

•Canada access: Gemini, CFHT (4-m OIR, wide FOV), 1-m scopes.

•65 Canadian Gemini PIs in 2011A-2012B, 133 Co-Is.
Gemini is workhorse telescope for Canadians.

GPI images of dust disk;
Marshall Perrin/STScI

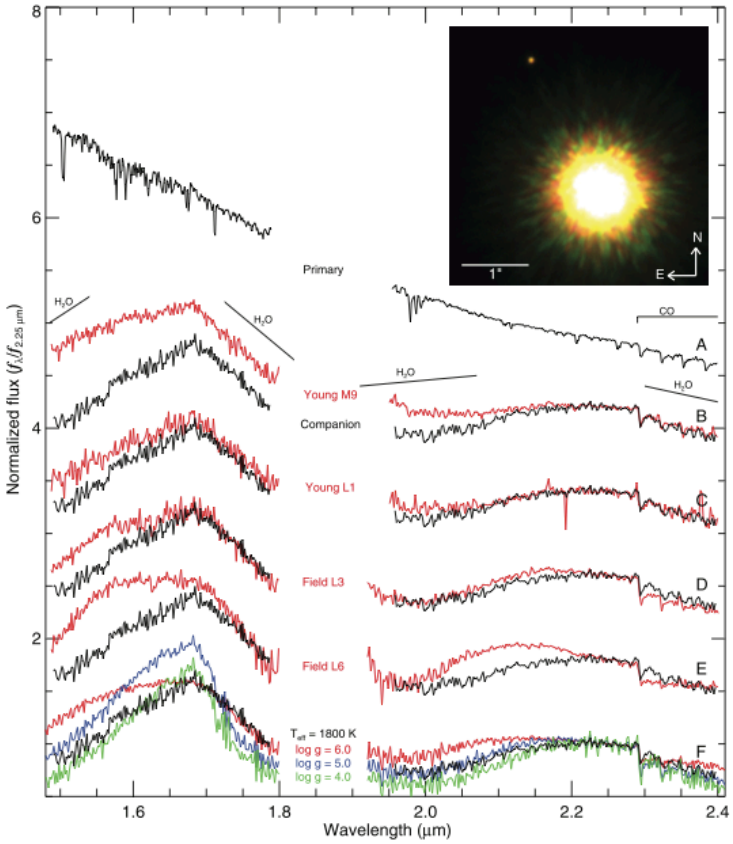


•Interested in surveys (often CFHT), instrument-building, AO, multiwavelength

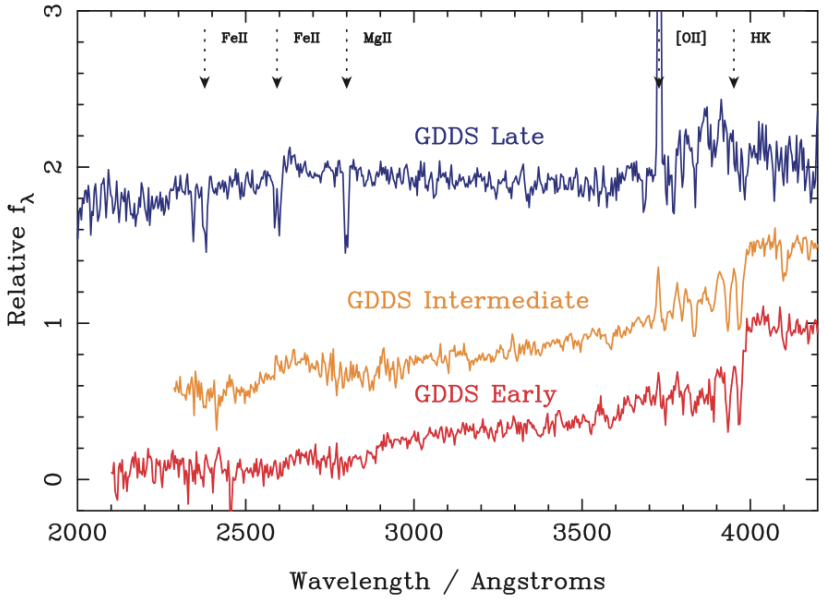
•Canada's NRC helped build GMOS, Altair, GPI

Canadian Science Foci

- Cosmology (galaxy evolution, distant AGN)
- Exoplanets, brown dwarfs, Kuiper belt
- Nearby galaxies, galactic archaeology
- Multiwavelength support (e.g. pulsars, XRBs)



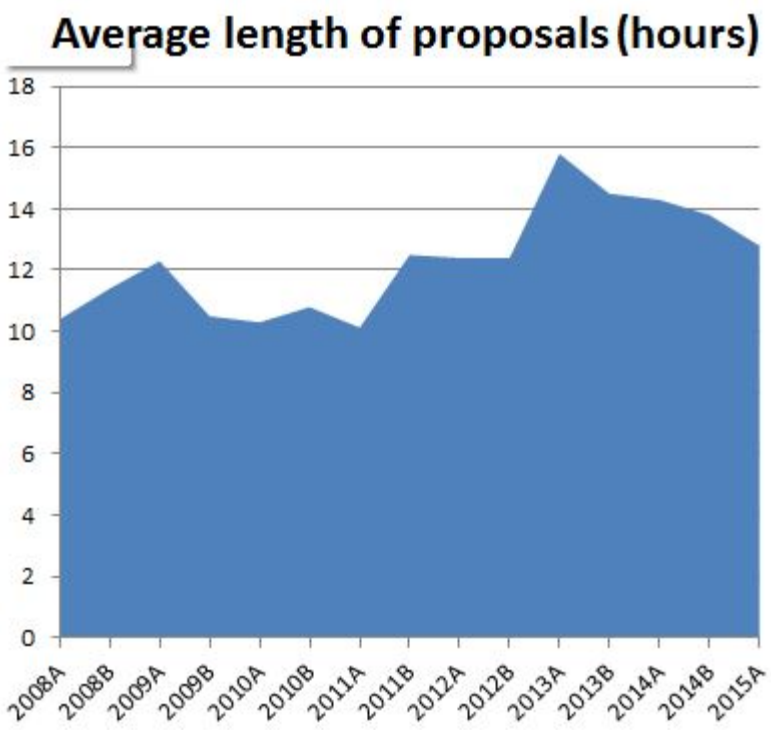
Lafreniere+08; image & IR spectra of young planet

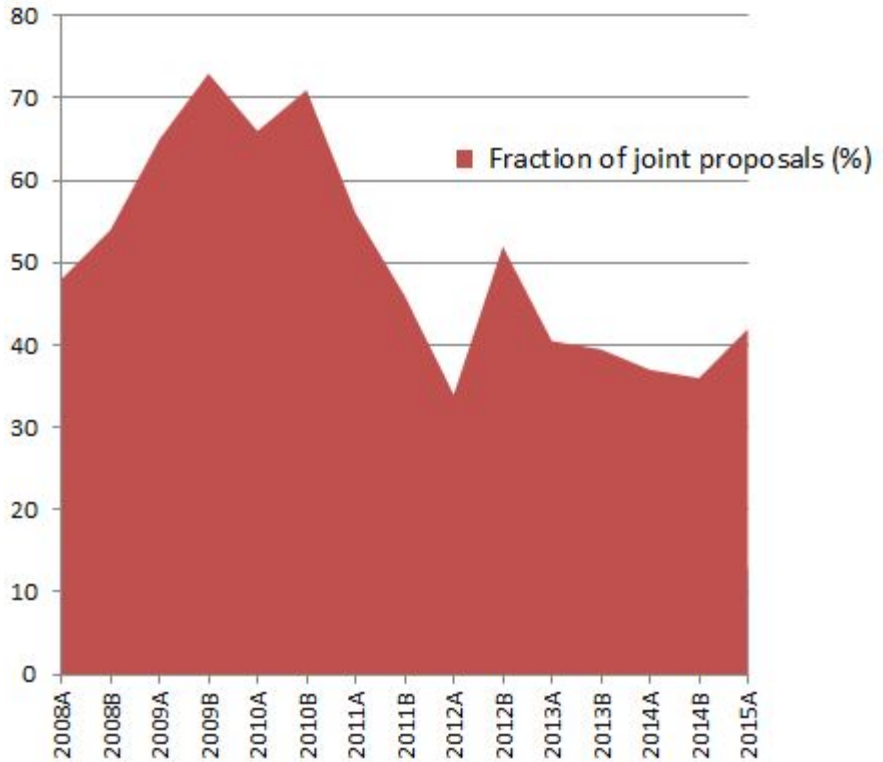


Abraham+04: Gemini Deep Deep Survey composite optical spectra

How Canadians use Gemini

- The average time requested per proposal remains very small
- However, Canada has the highest fraction of joint proposals, so that the total time requested in a proposal gets divided through the different partners.



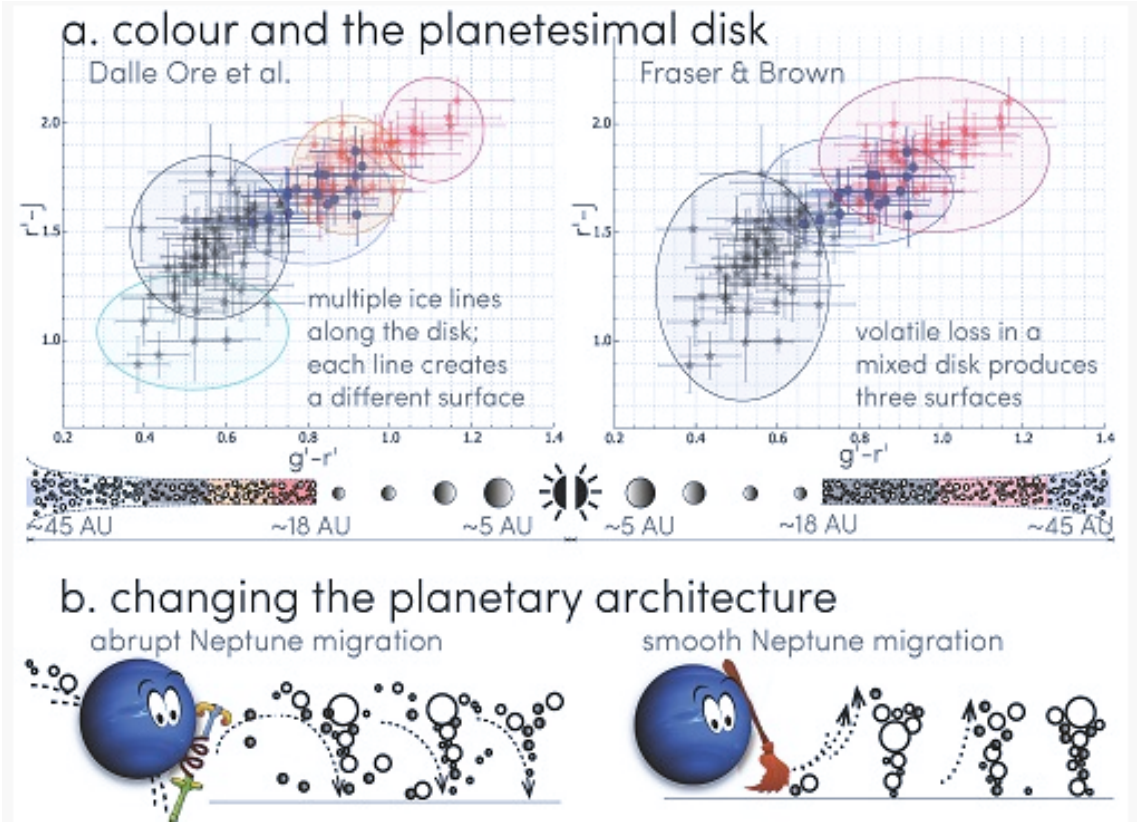


How Canadians Use Gemini

•Prefer queue (Canadian funding system makes travel expensive) over classical

•Experienced at designing surveys, often with CFHT imaging; also using Gemini (e.g. cosmology deep field, exoplanet surveys)

•Successful w/ Large/Long Projects. Canadians lead outer solar system (GMOS, NIRI), and galaxy cluster (GMOS) surveys.



Fraser+ COL-OSSUS solar system survey

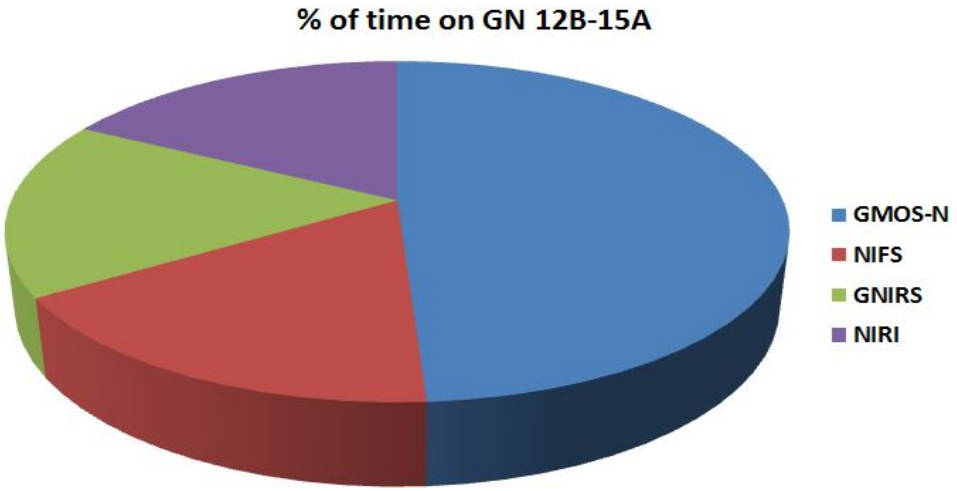
How Canadians Use Gemini

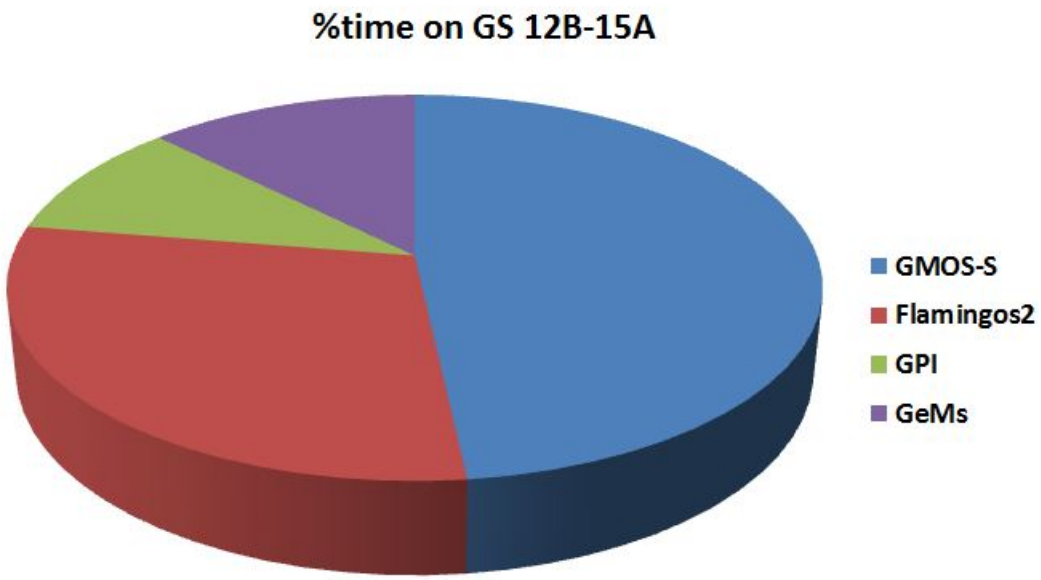
- Little ToO followup of SN/GRB/transients; community not well established, since requires a lot of telescope time.

- However, Dunlap Institute (U. Toronto) making deal bringing some Canadians into LSST. Thus, Canadian interest in LSST followup increasing….

Canadian Use of Gemini

Average over 3 years (semesters 2012B to 2015A):

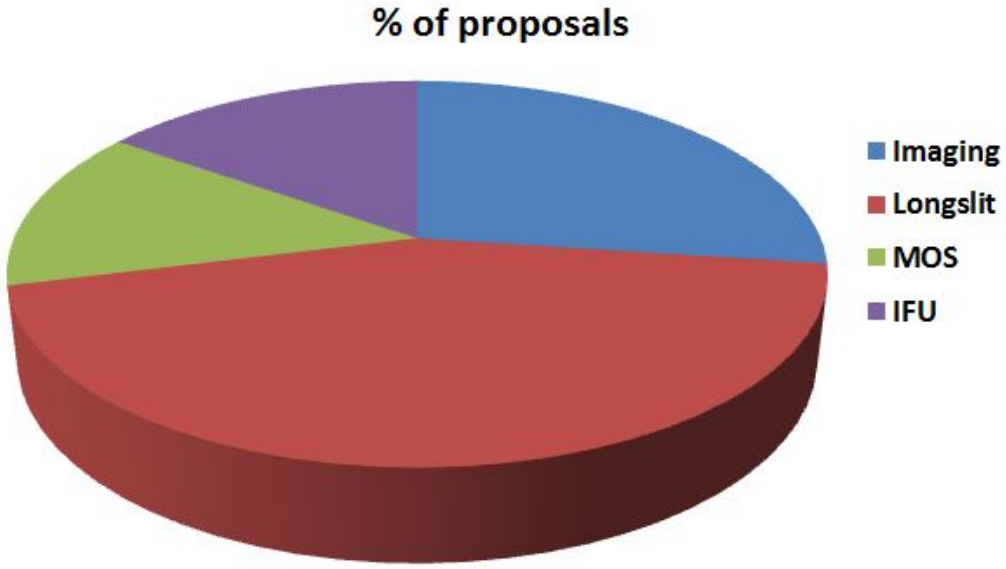




- Half of time is optical: GMOS-N & GMOS-S (49% each)
- Fully use available time on GPI & GeMs/GSAOI; limited AO availability
- Flamingos-2 Gem-S IR workhorse (30% of G-S), imaging & longslit
- Gem-N IR divided among imaging (NIRI), IFU (NIFS), longslit spectra (GNIRS)

Canadian Use of GMOS

Average over last 2 years (semesters 2014A to 2015B) for GMOS use:



GMOS modes:

- Longslit is now the most requested mode (44%)
- Then Imaging (27%)
- IFU and MOS similar (15%, 14%)

Use of AO:

- Canadians have a healthy demand for AO:
- Averaged over the last 2 years, more than half of the proposals for **GNIRS, NIRI or NIFS** request Altair AO (53%)

Long Term Goals with Gemini:

According to Canada's Long Range Plan 2010:

"Gemini's design emphasizes very high adaptive-optics-assisted image quality within a fairly narrow field-of-view. These design goals are shared by both TMT and E-ELT; when the next generation of 30m-class telescopes comes online the central capability of the Gemini telescopes will be surpassed."

The LRPP recommends that Canada's participation in Gemini be reconsidered as we reach the point that Canada's ~~VLOT~~ TMT project requires operating funds.

Canada has now officially joined TMT (with ~15% share).

Canada's Midterm Review of the Long Range Plan is considering Canada's long-term relationship with Gemini.

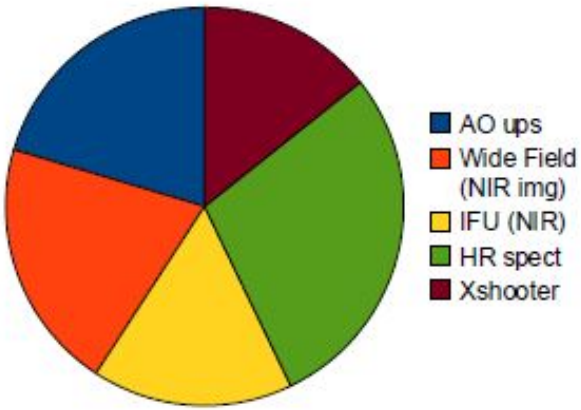
Short-Term Goals: Canadian Users Survey

Conducted in spring 2013 (by K.Venn STAC rep):

- 35 respondents
- Near-Term (<2020) Future Preferences:
  - High Resolution Spectroscopy (R>30000) – met by GHOST (possibly also GRACES)
  - Upgrading the AO system at Gemini-North
  - Also interest in wide-field near-IR imaging; wider-field near-IR IFU; Xshooter capability (for 2020+ time frame).

Future Preferences :	
AO ups	10
Wide Field (NI	10
IFU (NIR)	8
HR spect	14
Xshooter	7

HR spect = R>30,000 & Opt or NIR & MOS



Short-Term Goals: Gemini Users Survey

Conducted in spring 2015 (by Gemini):

- 53 respondents
- Near-Term (<2020) Future:

- Important instruments:
  GMOS-N, GMOS-S (workhorse!—13 listed either as 1st priority)
  GPI (small, devoted community—6 listed 1st priority)
  GeMs/GSAOI (4 as 1st)
  NIRI, GNIRS (many users, only 2, 3 as 1st)
  GRACES, GHOST (3 as 1st)
  NIFS, Flamingos-2 (only as 2nd priority)
  Altair as 1st for 4 users

- My takeaways:
  GMOS still essential (particularly for surveys).
  Advanced AO driving NIR scientific impact.
  High-res spectroscopy will produce impact.

Canadian Use of Gemini

Canadians Papers with most impact, up to 2012:

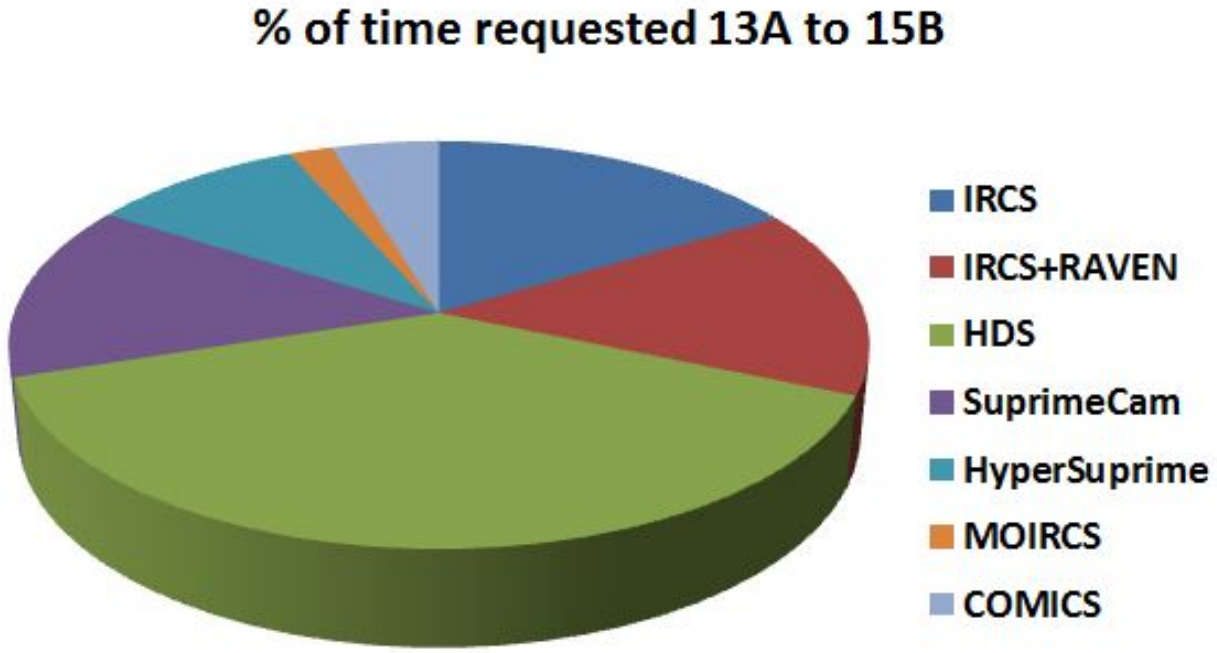
•On topics as diverse as exoplanets, pulsars, galaxy evolution at intermediate redshifts, and high-redshift QSOs

Marois, Christian et al , 2008	Direct Imaging of Multiple Planets Orbiting the Star HR 8799
Willott, Chris et al, 2010	The Canada-France High-z Quasar Survey: Nine New Quasars and the Luminosity Function at Redshift 6
Marois, Christian et al, 2006	Angular Differential Imaging: A Powerful High-Contrast Imaging Technique
Damjanov, Ivana et al, 2009	Red Nuggets at z ~ 1.5: Compact Passive Galaxies and the Formation of the Kormendy Relation
Juneau, Stéphanie et al, 2005	Cosmic Star Formation History and Its Dependence on Galaxy Stellar Mass
Lafrenière, David et al, 2007	A New Algorithm for Point-Spread Function Subtraction in High-Contrast Imaging: A Demonstration with Angular Differential Imaging
Lafrenière, David et al, 2007	The Gemini Deep Planet Survey
Abraham, Roberto et al, 2004	The Gemini Deep Deep Survey. I. Introduction to the Survey, Catalogs, and Composite Spectra
Willott, Chris et al, 2010	Eddington-limited Accretion and the Black Hole Mass Function at Redshift 6
Lafrenière, David et al , 2010	The Directly Imaged Planet Around the Young Solar Analog 1RXS J160929.1 - 210524: Confirmation of Common Proper Motion, Temperature,
Kaspi, V et al , 2003	A Major Soft Gamma Repeater-like Outburst and Rotation Glitch in the No-longer-so-anomalous X-Ray Pulsar 1E 2259+586
Lafrenière, David et al, 2008	Direct Imaging and Spectroscopy of a Planetary-Mass Candidate Companion to a Young Solar Analog
Damjanov, Ivana et al, 2011	Red Nuggets at High Redshift: Structural Evolution of Quiescent Galaxies Over 10 Gyr of Cosmic History
Willott, Chris et al, 2007	Four Quasars above Redshift 6 Discovered by the Canada-France High-z Quasar Survey

Canadian demand for Subaru Exchange Time

Average over the last 3 years (semesters 2013A to 2015B):

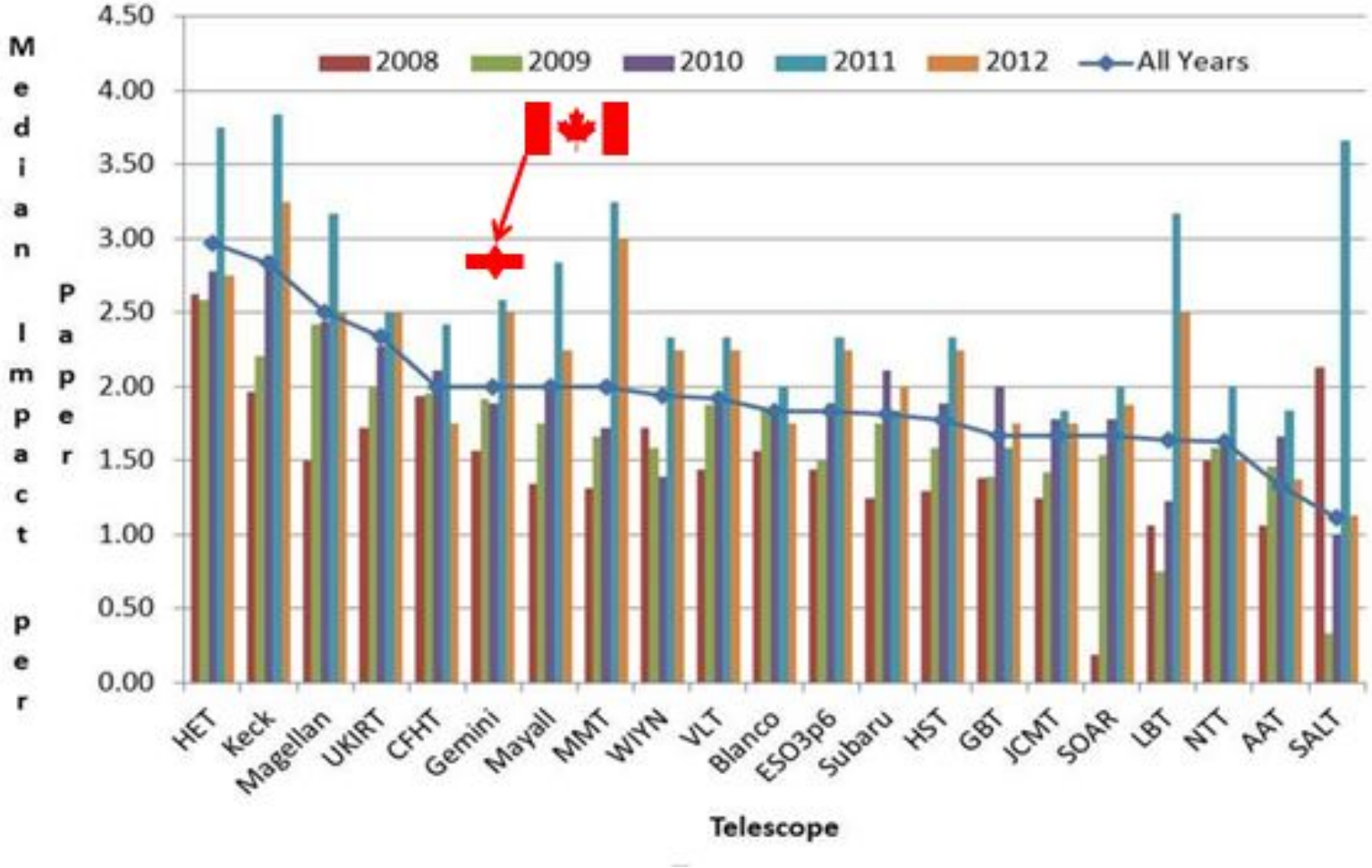
- There are 1 or 2 canadian proposals per semester, requesting an average of ~ 35 hours/per semester
- The most popular instrument is the HDS High Dispersion Spectrograph



Canadian Gemini Papers

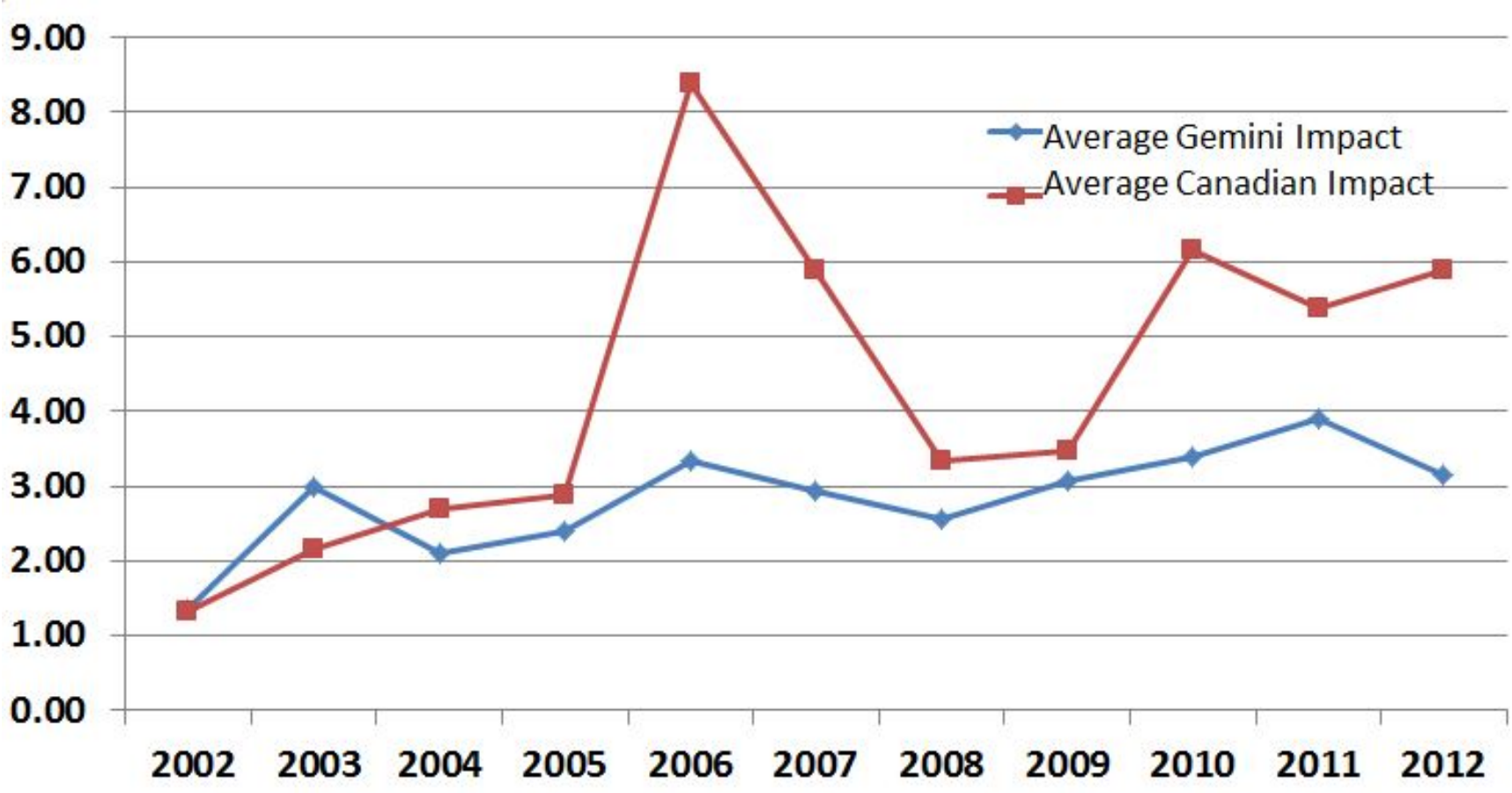
For papers 2008-2012:

- The **median impact** of Canadian Gemini papers is **2.8**
  - **Comparable to that of Keck papers**
  - **Much above Gemini overall median impact of 2.0**



Canadian Gemini Papers

Canadian Gemini papers have had consistently higher impact on average than all Gemini papers, with an average over 2008 to 2012 of **5.0** versus the Gemini average of 3.3



Canadian Use of Gemini

- In recent semesters roughly 40% of the canadian proposals had a MSc or PhD student as PI ot co-I
- During its 15 years lifetime Gemini has enabled more canadian theses than any other major facility to which Canada has access.

There are now 46 MSc and PhD theses that have been produced (or on-going) in a dozen Canadian universities.

There are now on average about 5 new Canadian theses per year using Gemini data.

Unlike the US where most of the glass is in the hands of a few…

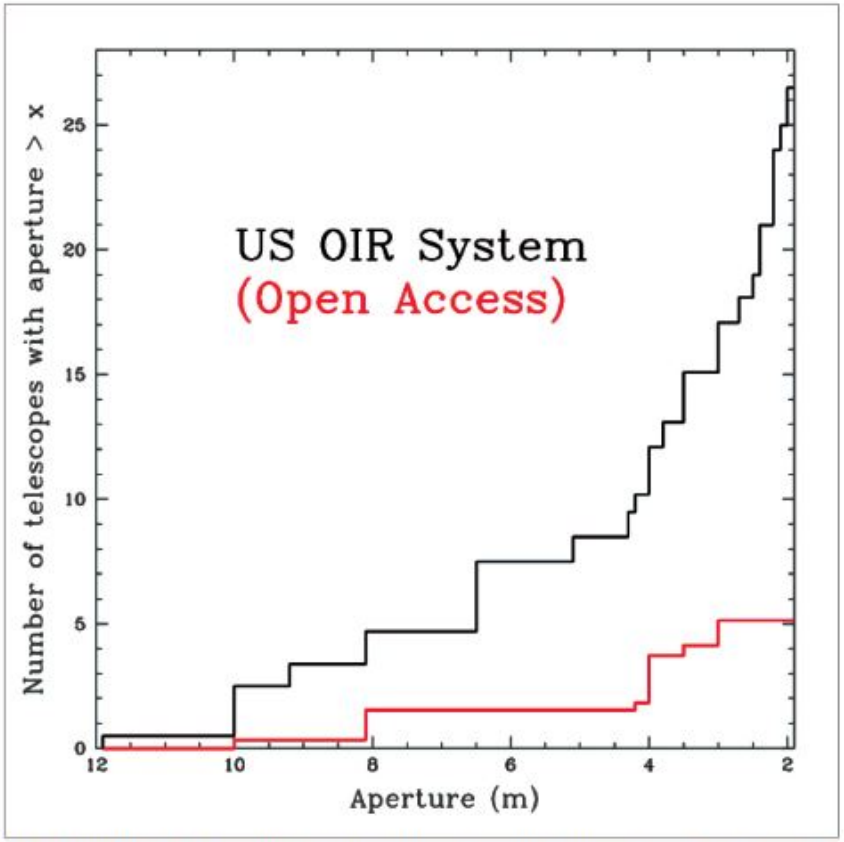


FIGURE 3.1 Number of telescopes with aperture greater than a given size, as a function of aperture. The black line shows the number in the system, including public and private facilities, while the red line shows the number publicly available.

..in Canada our only access to OIR telescopes > 2m are:

-Gemini-North and Gemini-South

-CFHT (3.6m)

accessible to the whole community

+ UofToronto has bought on occasions a few nights of Magellan/ Keck

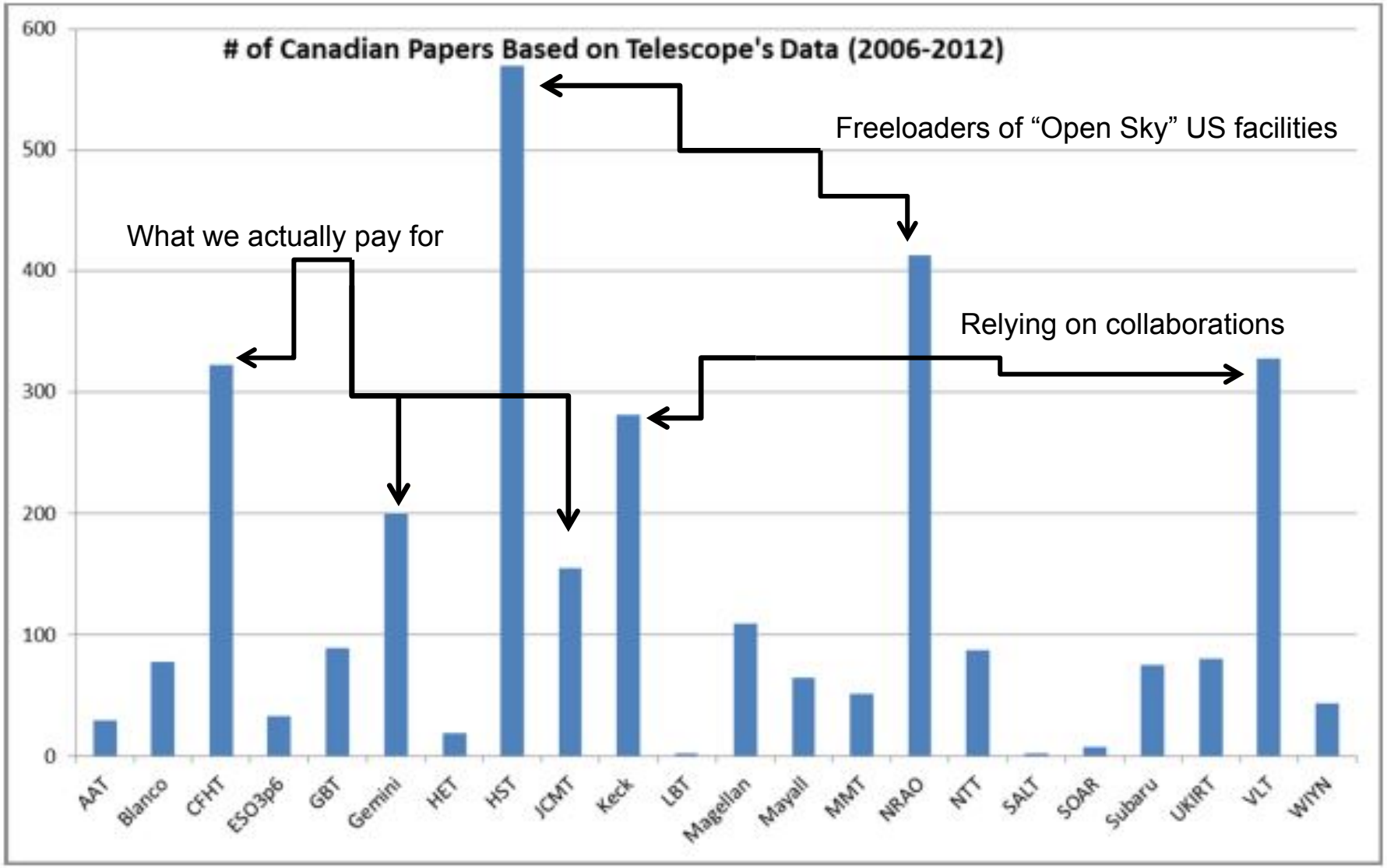
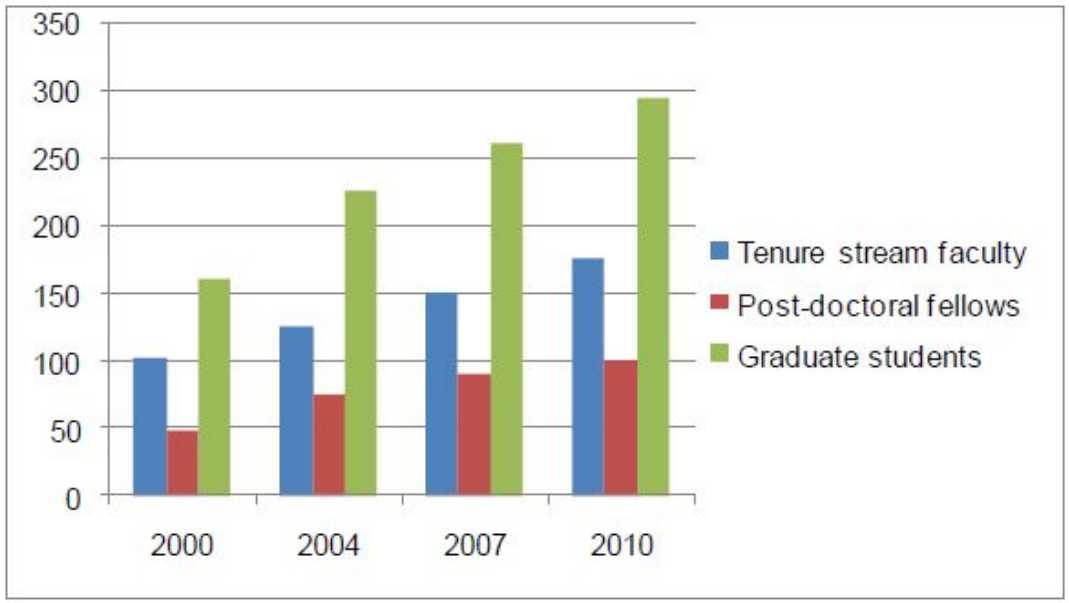


Figure 1. Number of publications in A&A, AJ, ApJ, ApJL, ApJS, Icarus, MNRAS,PASA, PASJ, PASP that include at least one author based at a Canadian institute from a range of facilities used by Canada-based researchers. (from D.Crabtree, see poster)

The Canadian Astronomical Community

- There are 590 members of CASCA (this includes students and postdocs)
- There are 240 canadian astronomers members of the IAU



A good fraction of them are **GEMINI USERS**:

-Over a 2-year period from 2011A to 2012B there were **133** individual Canadian Gemini PIs or CO-Is (and **65** unique PIs), far more than for any other canadian facility