From the South Pole to Dome C: Sub-mm facilities in Antarctica

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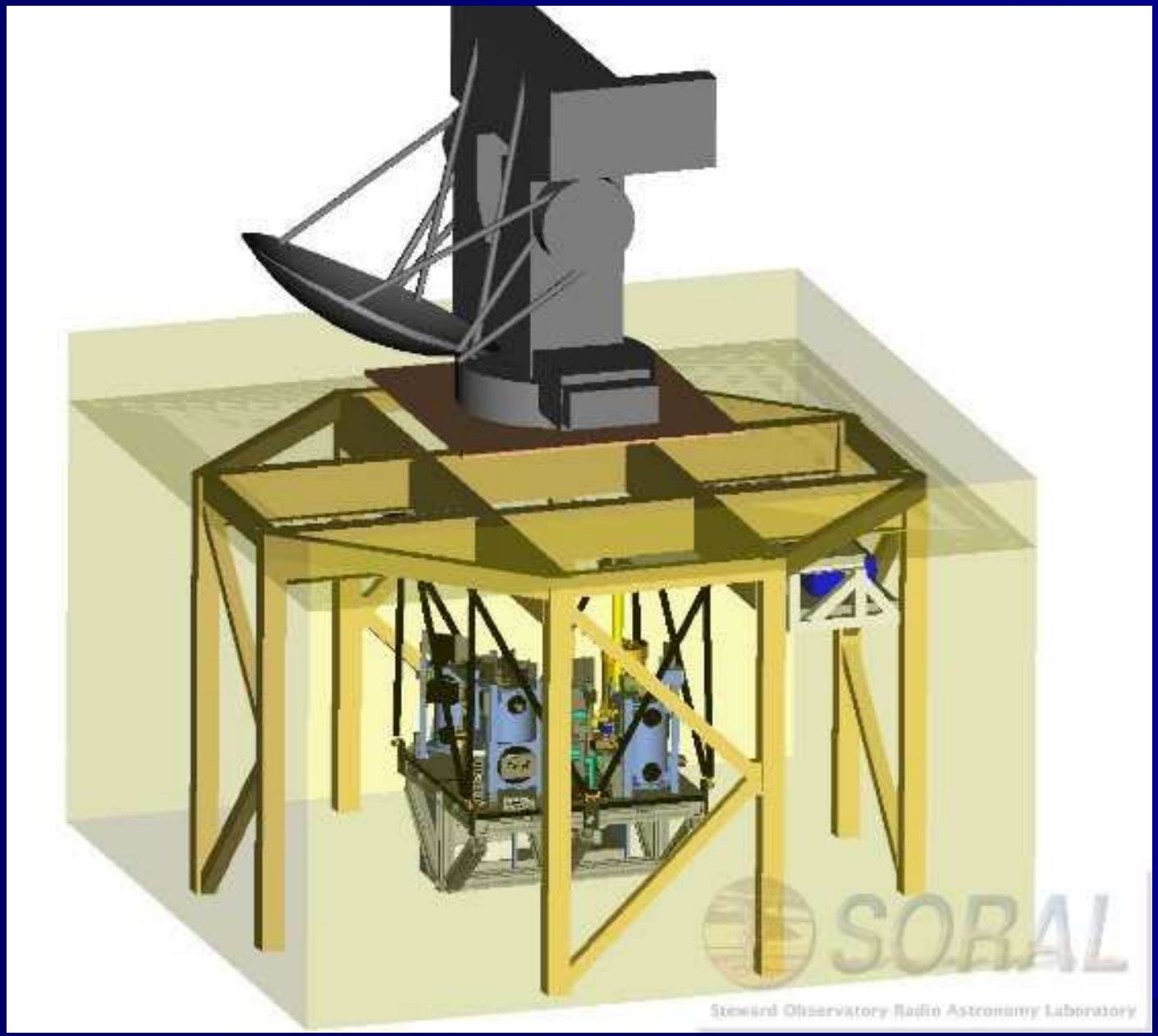
Overview

- AST/RO — a submm facility at the South Pole
- Science with AST/RO
  - Submm: star formation, galactic structure — THz
- From the South Pole to Dome C
  - spectroscopy only. . .
- Suggestions

South Pole

AST/RO



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Submm facility

- Facility v. Experiment (AST/RO or e.g. DASI)
- 1.7 m diameter
- Multiple rxs
  - 200–230 GHz
  - 460–492 GHz
  - 800–810 GHz, inc 4-pixel
  - TREND — 1.4 THz
  - SPIFI — 0.8 or 1.4 THz
  - no continuum instrumentation
- Backends
  - 2 LRS, 1 HRS

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AST/RO Science — general

- Main transitions:
  - CI: 492 and 809 GHz
  - mid-J CO: 4–3 and 7–6
  - low-J CO: 2–1 with isotopologues
- beamsize 1–3 arcmin
- optimised for large-scale mapping of pervasive tracers

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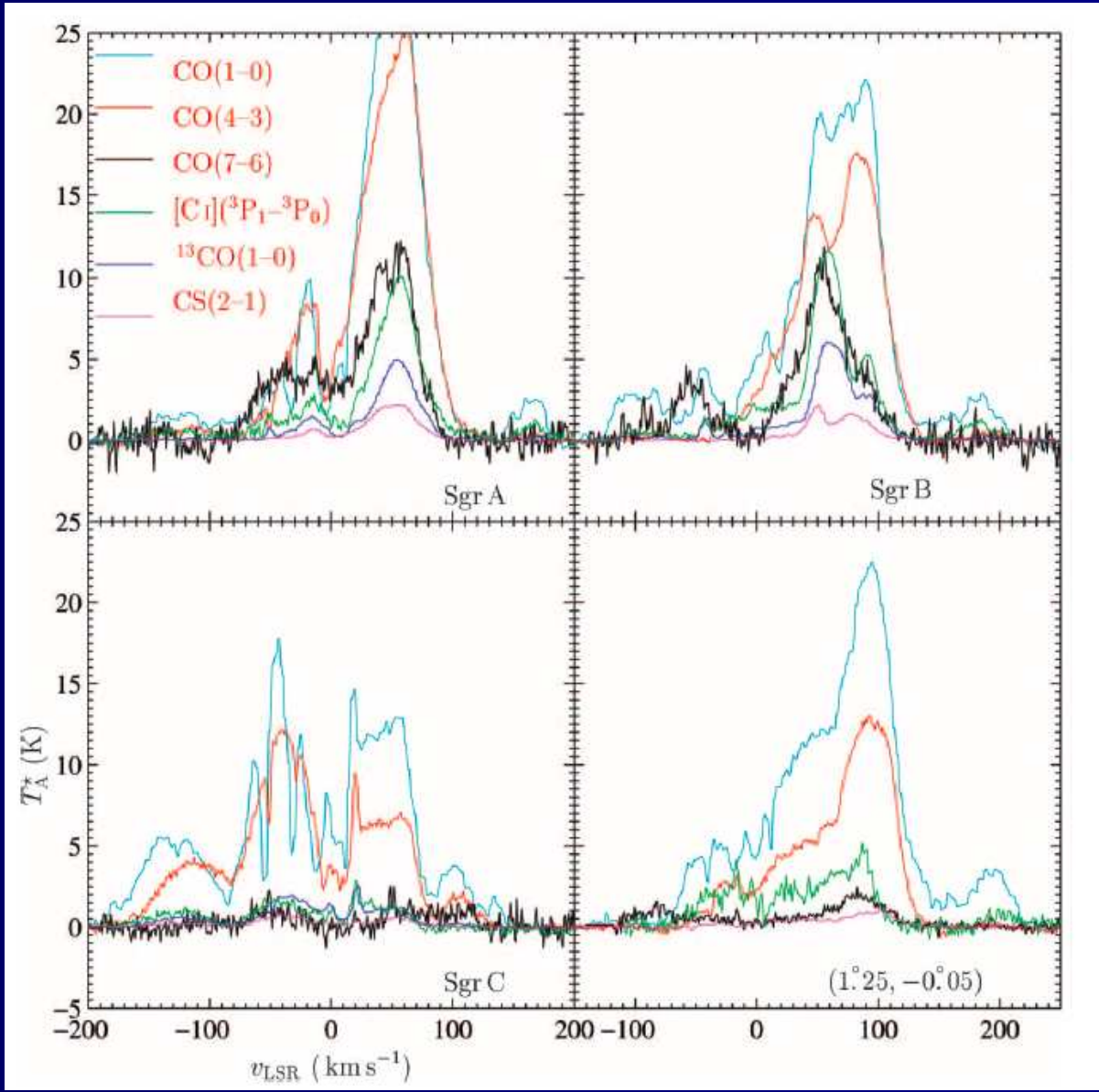
Galactic Centre



Galactic Centre high-ν stability Martin et al 2003

Galactic Centre mapping

- mapping Galactic Centre in CO 4–3, CI (492), CO 7–6
- 1.7 square degrees; 24,000 positions; 72,000 spectra
- $\geq$ 60 s integration; $>$ 50 days of on-source integration time
- Martin et al 2003

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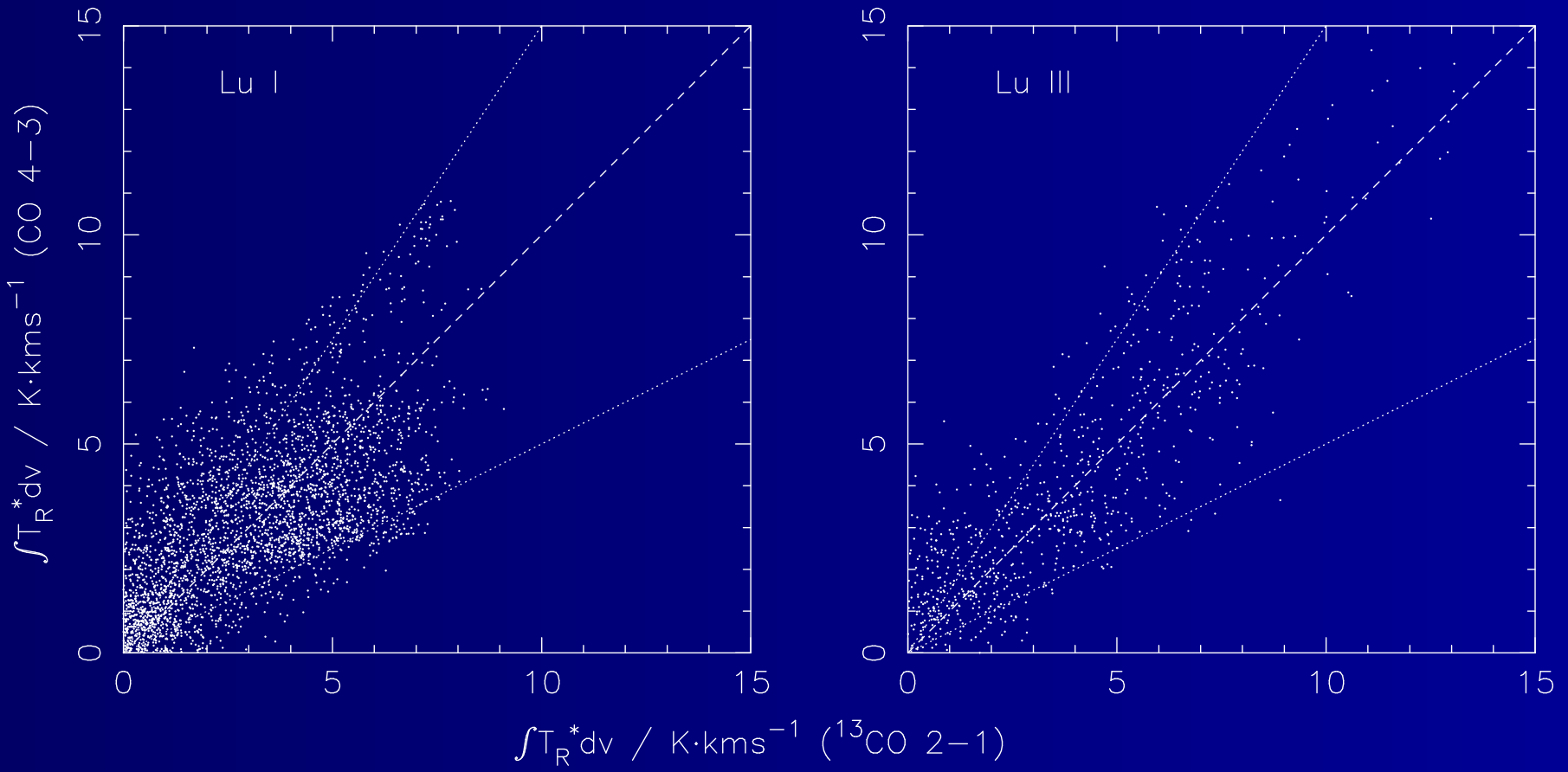
Star Formation

- Mapping nearby SF regions in ^{13}CO 2–1 and CO 4–3
- regions from c2d: Lupus, Chamaeleon, nearby cores
- 40 cores, map size $\sim 10' \times \sim 10'$
- ~ 40 days on-source integration (submm only)
- Loehr et al 2007

Lupus

- Lupus I, III, IV
- $>$1 sq degree in CO 4–3, $>$17,000 spectra
- covered a small part of the Lupus complex

Lupus I & III — line ratios



NII mapping

- detection of NII from η Carinae with SPIFI
  - 25-channel array
- THz campaign in August/Sept 2005
  - commissioning, setup, observing
- Oberst et al 2006

From Pole to Dome C

- Better weather
  - how much better?
- More sky - another 15° in dec
  - GC from 25° elevation to 40° — airmass 2.4 to 1.3
  - planets are much more observable

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From 1.7 m to $\sim$10 m

- pointing sources
- dense gas tracers
  - more physics eg B
  - transitions at bad frequencies eg H_2D^+ 372 GHz
- extragalactic — large v range

Dome C Transitions

Trans	Freq/GHz	$\tau_{0.2}$	T_{on}(0.1K)	$T_{on}(1'^2)$
CI	492	0.3	2m	3h
CI	809	0.4	4m	27h
CO 4–3	461	0.2	1m	2h
CO 6–5	691	0.3	2m	8h
^{13}CO 6–5	661	0.3	2m	8h
CO 7–6	807	0.4	4m	27h
H_2D^+	372	0.2	1m	2h
D_2H^+	692	0.3?	2m	8h

Need multi-beam receivers

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Standard Survey Products

- Size of survey product depends on site-testing
  - few hours suggests few square arcmin
- THz would still need to be ‘by hand’
- A caveat: data transmission, especially for multi-beam rxs

November 2003. . .

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. . . and August 2004

Suggestions

- Stability
- Surveys
- Standardisation