

Developments in Sub/Submillimeter Astronomy in Chile



Mónica Rubio
Universidad de Chile

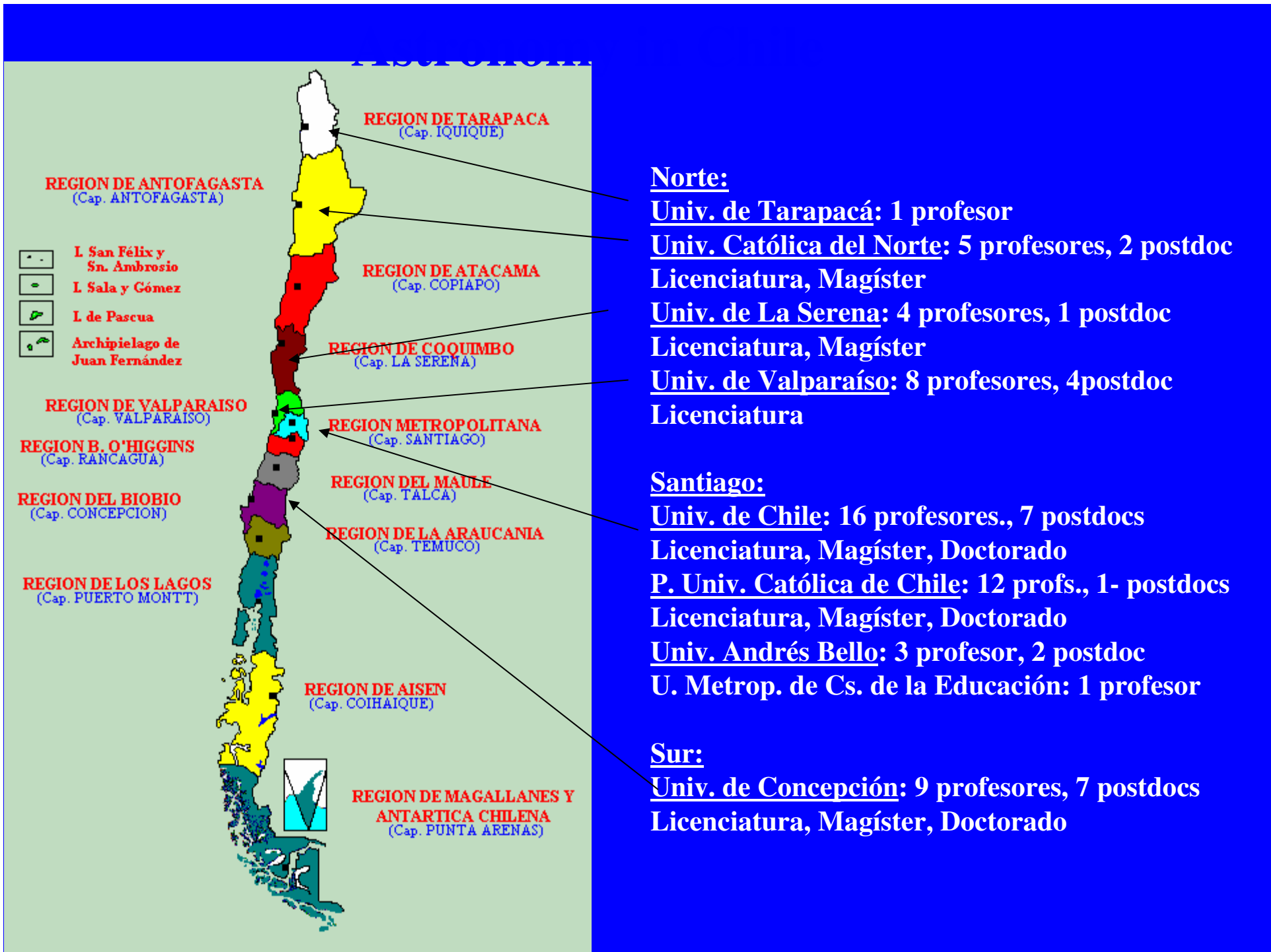
The start

- **Collaboration between Columbia University and UCH 1984**
- **1.2 m radio telescope at CTO in 1984**
- **115 GHz CO surveys of the Southern Milky way and Magellanic Clouds.**
- **SEST Telescope @ La Silla 1987-2003**

**Radio astronomy group at the Astronomy Department,
U Chile, 5 Faculty**

Today

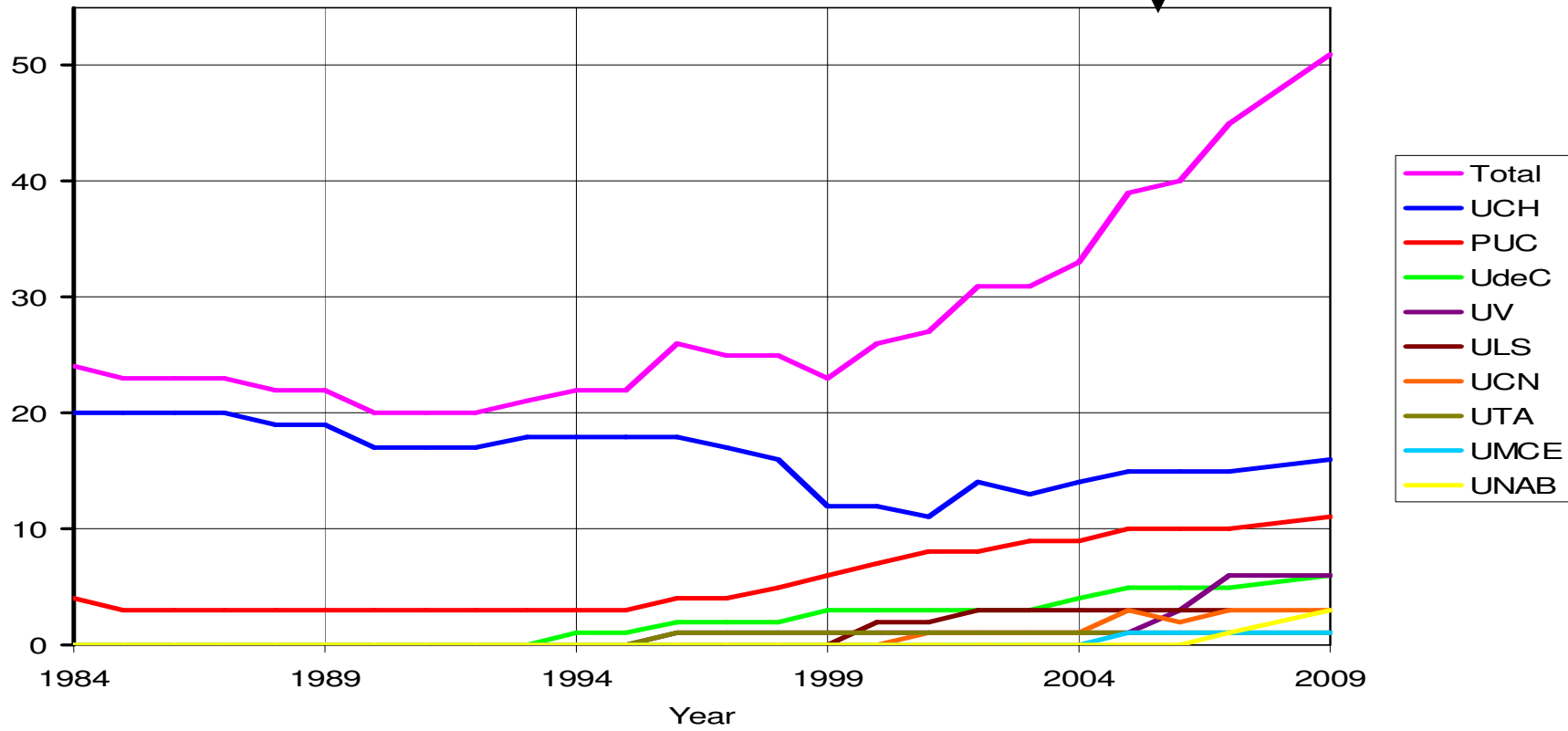
- **Seven universities with astronomy departments/groups**
- **One radio-astronomer in each of the new ones**
- **Graduate students performing Ph D and Master's thesis in submillimeter astronomy**



Astronomers in Chilean universities

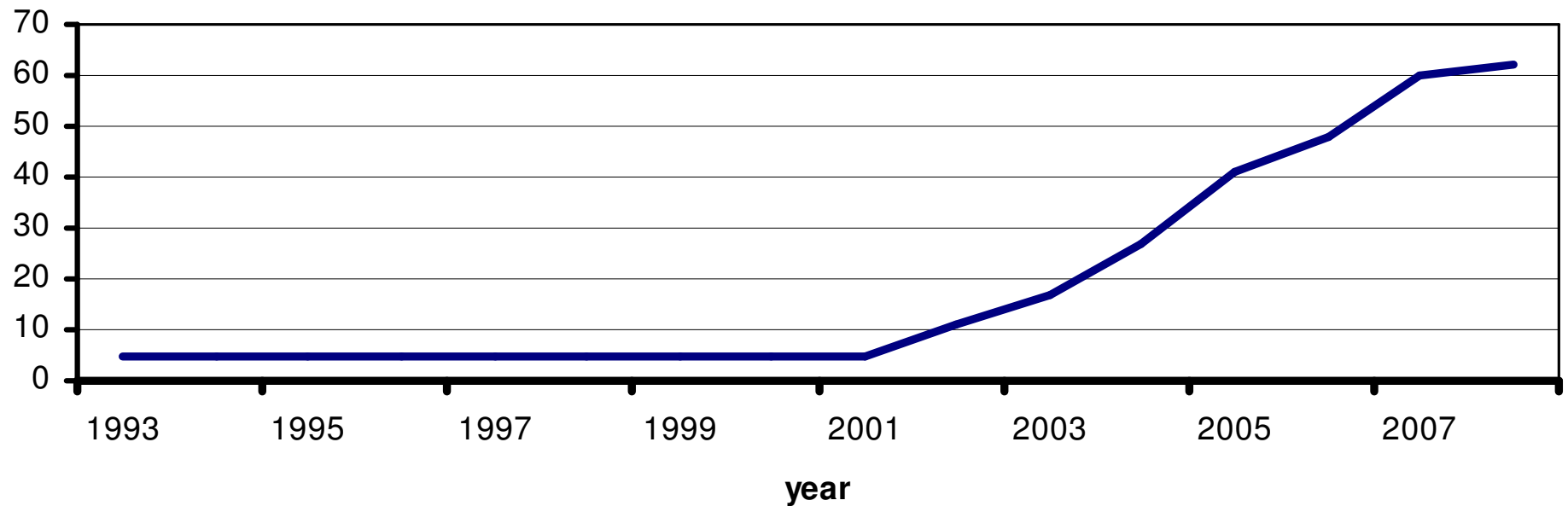
Faculty + posdocs = 100

Alma and Gemini Funds



Master + PhD students in Chile

Graduate students



Undergraduate: 250 students

Developmenemnts in Chajnantor Plateau (5000m) San Pedro de Atacama

Radio Telecopes and IR telescopes IR: 2000→

CBI , Caltech, USA

- APEX Germany & ESO antena de 12m
- ASTE, Japan antena de 10m
- NANTEN2 4m antenna
- ACT, 6m Princeton antenna 6m
- CCAT 25 m telescope
- mini-TAO, U. Tokio, 1.0 m telescope
- TAO U. Tokio 6.5m telescope

Chajnantor is an excellent and unique area for sub-millimetre observations.

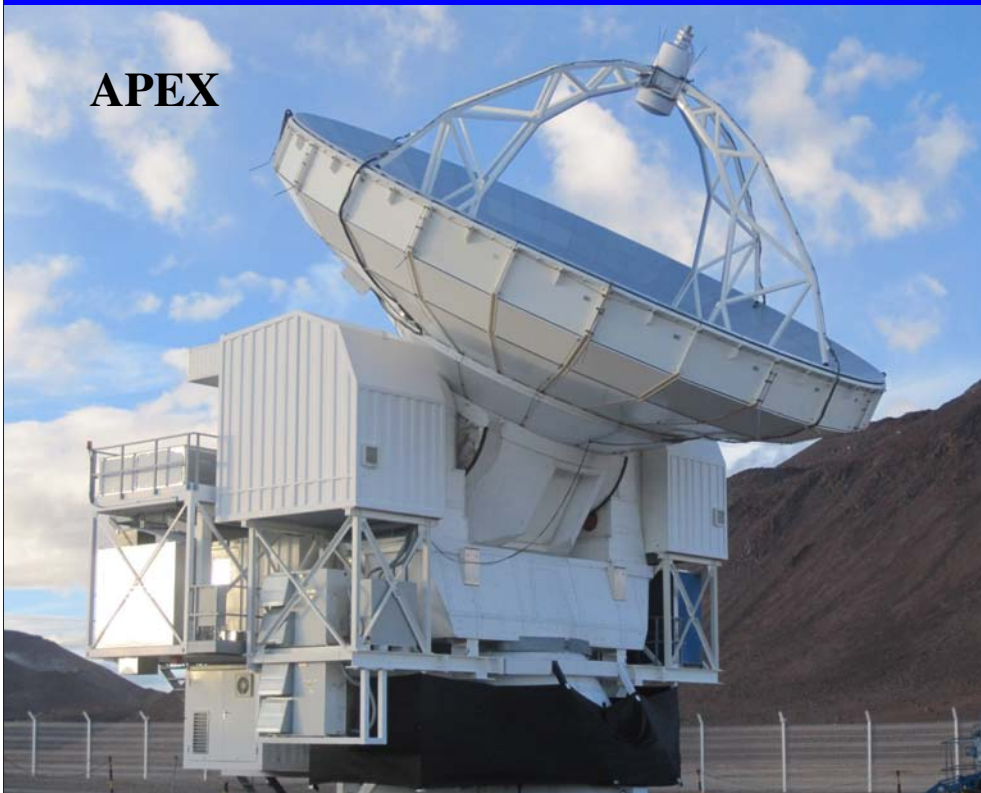
Submillimeter Telescopes

Chile has 10% of the Observing time

NANTEN II



APEX



ASTE



Instrumentation Development

- **UCH: PhD in astronomical instrumentation. Collaboration between Electrical Engineering and Astronomy Departments**
- **PUC. Astro-Engineering Center Engineering, Computer Sciences and Astronomy**
- **UdeC: Radioastronomy Group**
- **U Federico Santa María:
Software development for ALMA Control System**

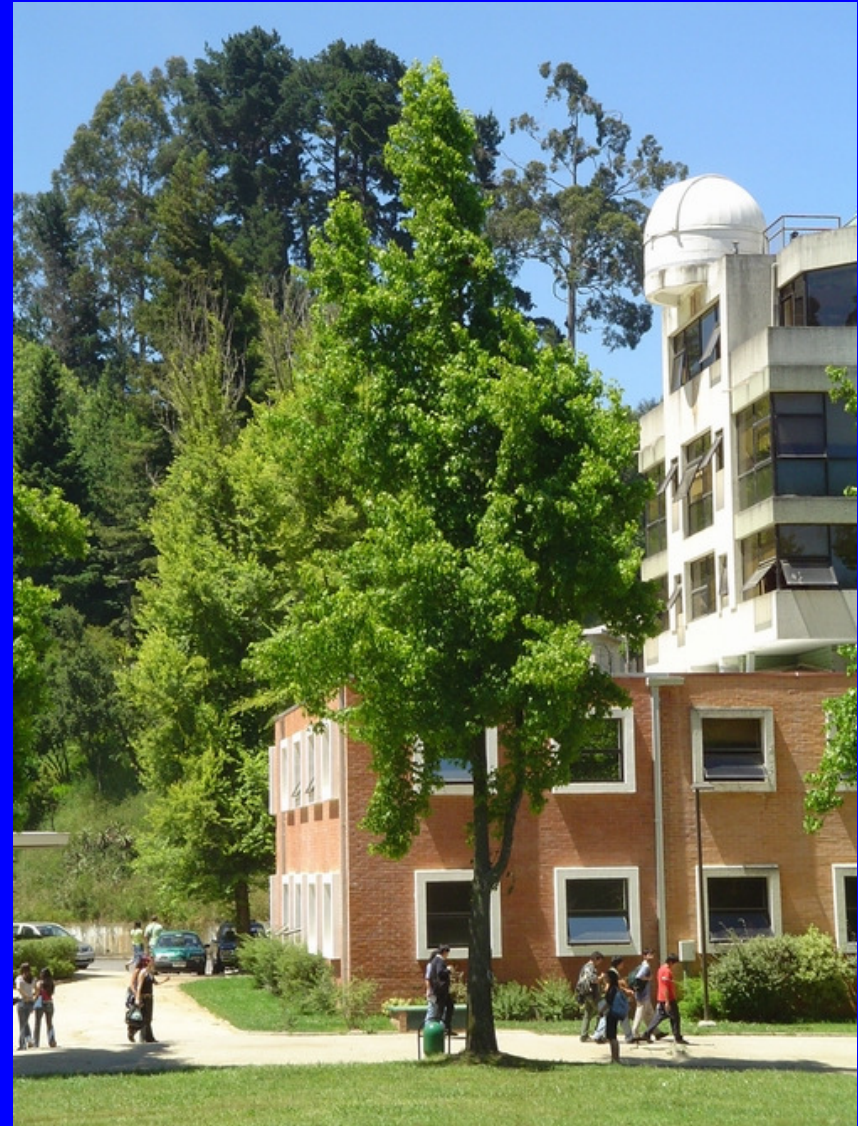


Universidad de Concepcion

**Grupo de Astronomía
Facultad de Ciencias Físicas y
Matemáticas**

**BSc Astronomy
PhD in Physics (Astrophysics)**

<http://cluster.cfm.udec.cl/>



Radio-Astronomy at U.de Concepción (UdeC)



- Long-term experience in the Chajnantor area.
- Collaboration with CBI/QUIET since 2002:
 - 3 Ph.Ds, 2 engineers, several observers (students).
 - Operations, engineering, observations, CMB science.
- TIGO VLBI 6m telescope on UdeC campus:
 - Training of EE and Astronomy students.
- Radio-Astronomy Laboratory, UdeC:
 - 183 GHz water vapor radiometers at the QUIET and CCAT site
 - Development of low cost digital oxygen and water vapor radiometers.



183 GHz radiometer next to QUIET

Radio-Astronomy at U.de Concepción (UdeC)



Science Areas:

- Galaxy evolution and star formation history at high- z :
 - ULIRGs and SMGs at z 0-5.
 - Galaxy evolution with high- z galaxy clusters.
 - CO Tully-Fisher at high redshift.
 - Spitzer Adaptation of the RCS (SpARCS; PI: G. Wilson).
 - APEX/ALMA follow up for Herschel-ATLAS.
- Sub-millimeter wave surveys.
- CMB and SZ effect.
- PWV studies in the Chajnantor area.
- Members: Demarco, Nagar, Bustos, Nantais, Leiton, Orellana, Slater.



Pontificia Universidad Católica

Departamento de Astronomía y Astrofísica

www.astro.puc.cl

**BSc and PhD
in Astronomy**

Astro-Ingenieria

- IR instrumentation
- Numerical Simulations

**Agreement with U Maryland
Carma**



Members: G.Galaz, L.Infante, L. Vanzi, M. Padilla .



Centro de Astro - Ingenieria of PUC

Joint project of the Dept of Electrical Engineering and the Dept of Astronomy and Astrophysics

Objectives:

Research - Start a group able to contribute to the major international projects of astronomical instrumentation

Didactic - Provide a strong background of astronomical instrumentation to students of Astronomy, Engineering and Physics

Main areas of interest: visible and infrared instrumentation (optics, detectors, cryogenics)

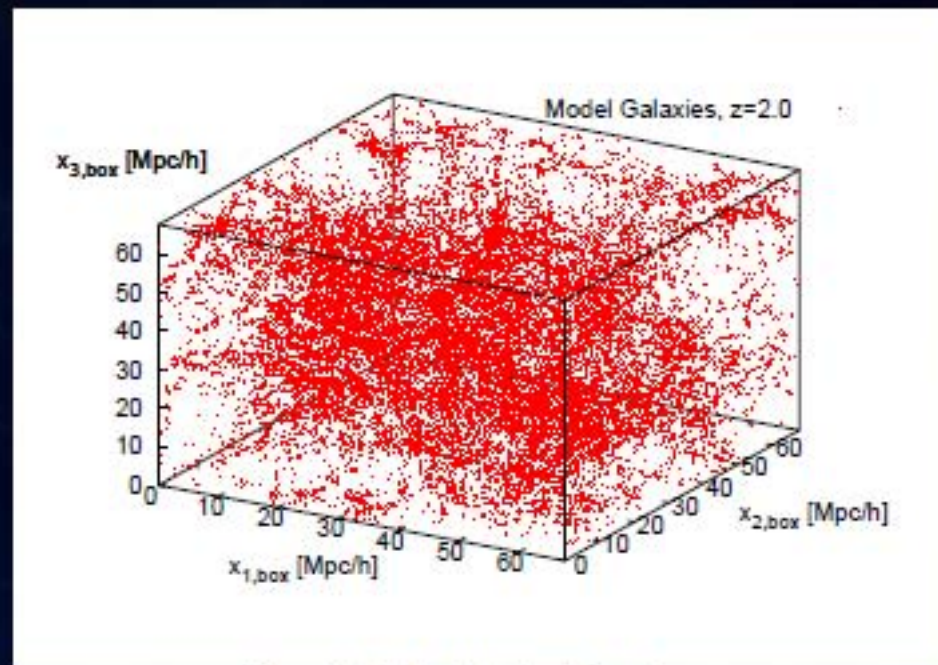
Contact: Prof. Leonardo Vanzi - lvanzi@ing.puc.cl

A Variable IMF Slope To Fit The Λ CDM Picture To Observed High- z Submillimeter Sources

Alejandra Muñoz & Nelson Padilla (PUC)

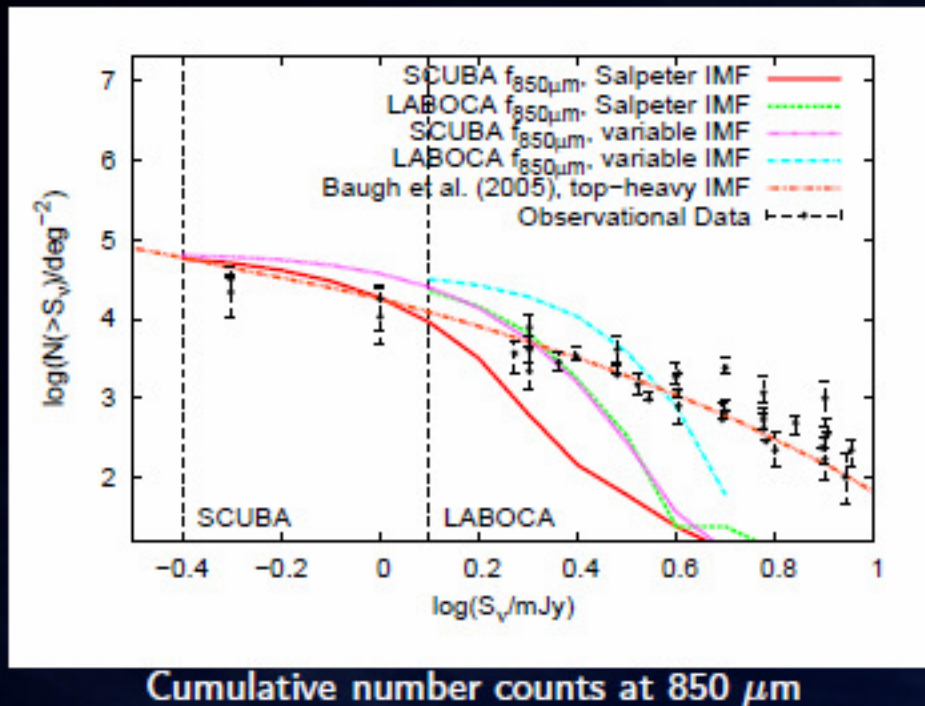
Collaborators from UNLP, Durham University, MPIfR, Rutgers

**Mock catalogues from
cosmological numerical
simulations, including the
reprocessing of light by
dust**

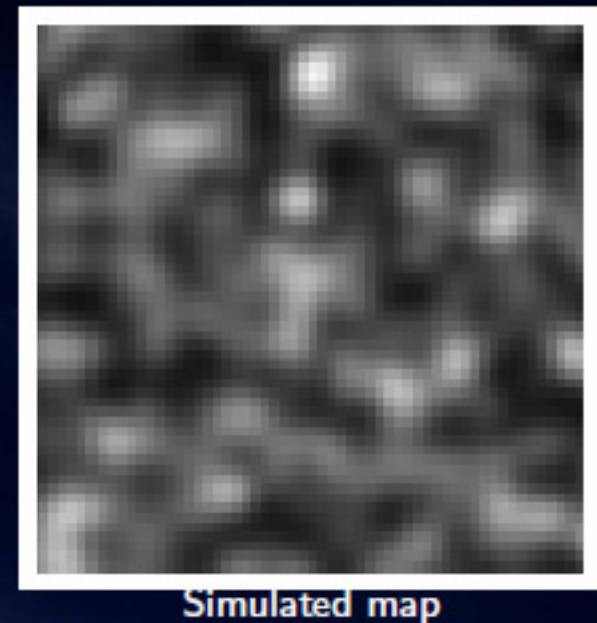


Simulated galaxies in a box

Effects from a variable IMF slope (closer to top-heavy in bursts)



LABOCA observing a Λ CDM Universe



Institutions in Chile

Departamento de Astronomía
Universidad de Chile



BS, MSc and
PhD (1999)
in Astronomy

www.das.uchile.cl



Observatorio Cerro Calán



Millimeter Radioastronomy

**Band 1 ALMA
receiver prototype**



**Interest to collaborate with CCAT ZEUS visitor instrument in
APEX (E. Michael , Electrical Eng. Dept- UCH).**



Science at DAS UCH

- **Massive Star Formation and ISM**
 - **Massive star formation in the MW
ATLASGAL (L. Bronfman)**
 - **Studies Dark IR Clouds and Filaments
(G. Garay & D. Mardones)**
 - **Studies of circumstellar and interstellar
medium (S. Cassasus)**
 - **Studies of the cold gas and star formation in
the Magellanic Clouds (M. Rubio)**

Science Areas in Sub/mm

- Star formation and ISM
- Protoplanetary disks
- AGN's
- Low metallicity and low surface brightness galaxies
- High - z galaxies
- Galaxy Formation

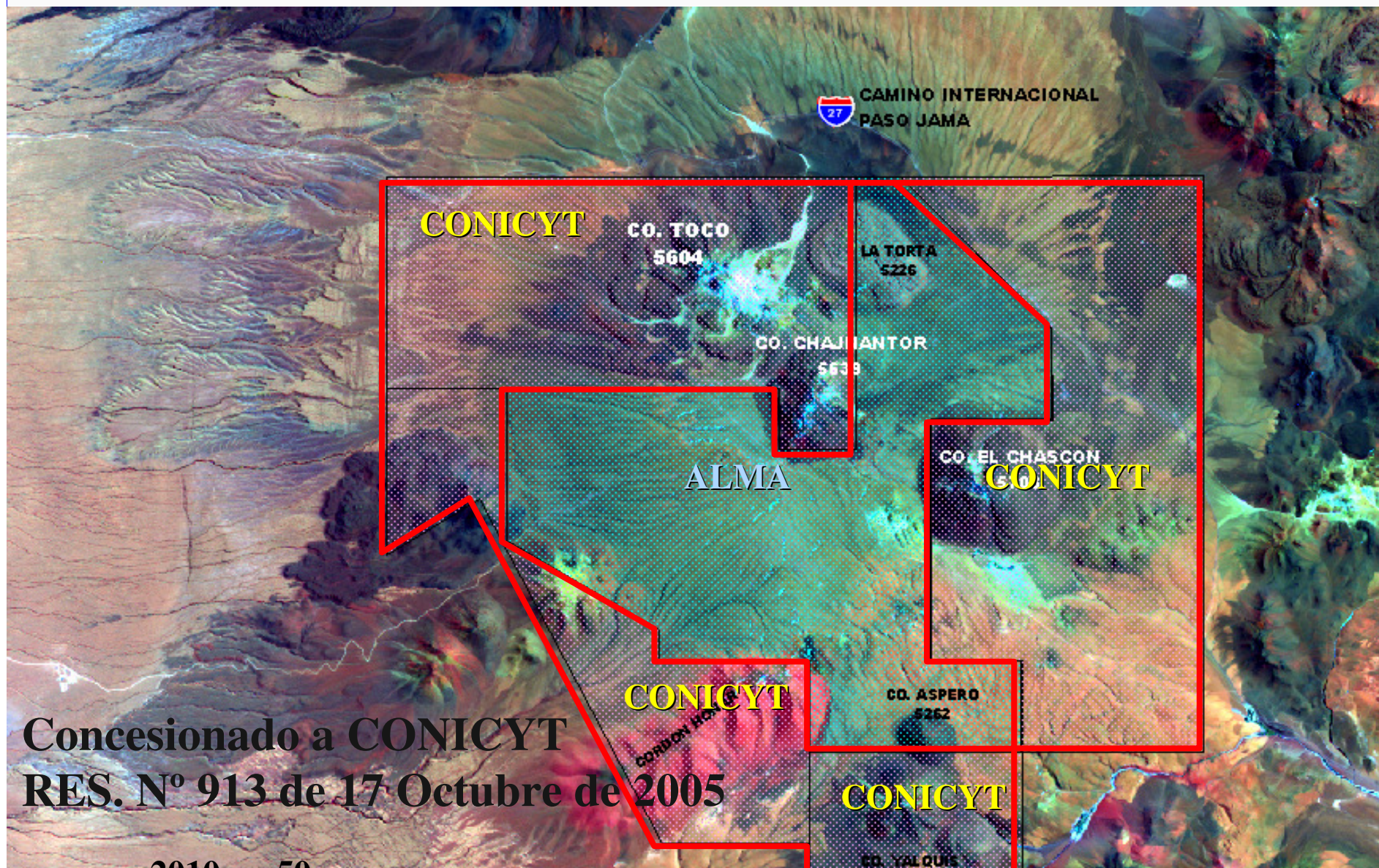
AAS : Postdoc and faculty announcements

The Future



Aug 10, 2010

Parque Astronómico Atacama



**Concesionado a CONICYT
RES. N° 913 de 17 Octubre de 2005**

Observatories in Chajmantor Mountain

Mini-TAO
(U. Tokio 1m)



Collaborations



CCAT

CHAJNANTOR COSMIC ATACAMA TELESCOPE

25 m sub-mm Telescope

