Manuel Merello (ANID)
Kalle Torstensson (ESO)
October 28th, 2021

Outline

- Telescope overview
- Science highlights
- Proposals: application and evaluation
- Planning proposals

APEX telescope

- Atacama Pathfinder Experiment (APEX)
- 12m antenna, millimetre & sub-millimetre **from ~ 160 GHz up to 800 GHz.**
- Located in Chajnantor plateau, 5100 m elevation.
- Observations performed from Sequitor base camp, at San Pedro de Atacama.
- Partners (valid until end of 2022):
    1. The Max-Planck-Institut für Radioastronomie (55%)
    2. European Southern Observatory (32%)
    3. Onsala Space Observatory (13%)
- Chile as host country, access to 10% obs.

Max-Planck-Institut für Radioastronomie

http://www.apex-telescope.org/ns/

Fifteen years exploring the dry southern skies over the Chajnantor plateau

Control room at Sequitor

2022

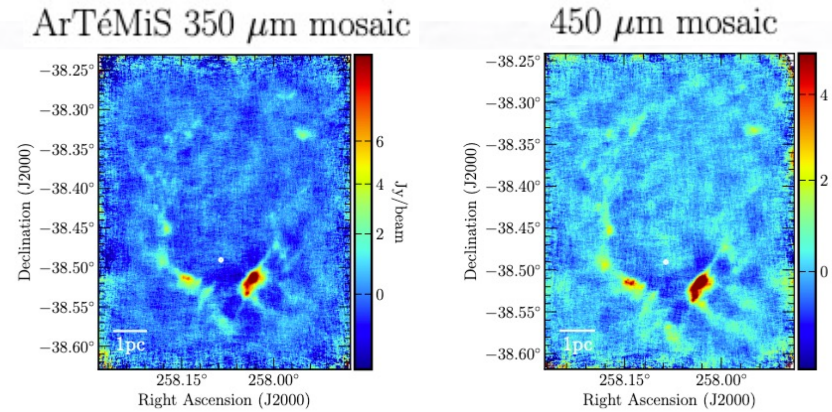
Days

Science Time partners			262
MPIfR	55%	49,50%	130
ESO	32%	28,80%	75
OSO	13%	11,70%	31
Chile	10% tot	10%	26

For 2022-A > **May 1 - 7**
July 17 - 22

- In a normal year, the Chilean community has ~ 300 hrs of telescope time each semester.
- Winter semester (Mar - Jul), observations are done 24 hrs.
- Summer semester (Aug - Dec) has restrictions of sun-avoidance.

Capabilities



ArTéMiS

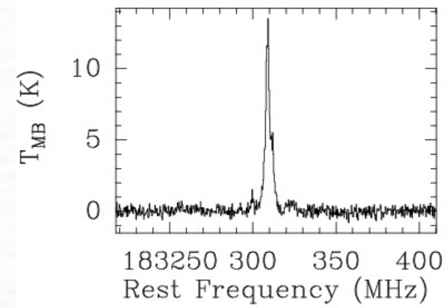
RCW 120

Zavagno et al. (2020)

- Instruments:
  Bolometers (continuum emission)
  ArTéMiS

  Heterodyne receivers (line emission)
  SEPIA180/345/660; nFLASH230/460;
  CONCERTO
  http://www.apex-telescope.org/ns/concerto/
  https://mission.lam.fr/concerto/

SEPIA180



- Observing modes:
  ON-OFF: simple integrations on one position (or in various positions to be specified)

  Raster map: A series of ONs distributed regularly in a map

  On-The-Fly: Continuous mapping with a data dump every few arcsec in scan direction

- Software for line observations: GILDAS - CLASS
  http://www.iram.fr/IRAMFR/GILDAS/

Why you should apply for observing time with APEX

- Unique instrument in the Southern Hemisphere
  South> Nobeyama (Japan, 45m) : 17-115 GHz
  Parkes (Australia, 64m) : 0.3 – 110 GHz
  North> Effelsberg (Germany, 100m) : 0.39 – 95 GHz
  IRAM (Spain, 30m) : 110 – 230 GHz
  ARO (12m) : 84 - 275 GHz
  JCMT (15m) : 86 - 345 GHz

- Complementary to ALMA observations
  Single dish-observations, “zero-spacing obs.”
  Similar frequency bands

- Opportunity for students and new researchers
  Galactic studies, star formation, astrochemistry
  Nearby galaxies, high-redshift galaxies, LMC & SMC

- **~230 publications with APEX data, since 2018**

APEX bands

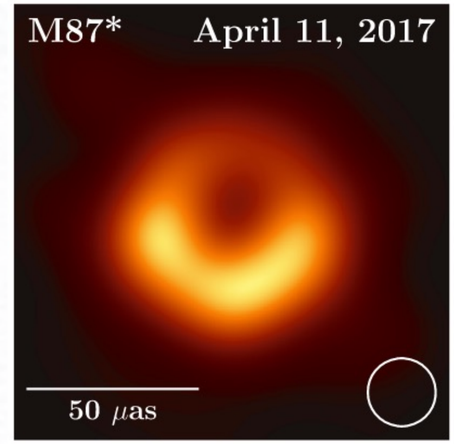
- **B5 ~170 GHz (HCO+ 2-1)**
- **B6 ~230 GHz (CO 2-1)**
- **B7 ~345 GHz (CO 3-2)**
- **B8 ~460 GHz (CO 4-3)**
- **B9 ~691 GHz (CO 6-5)**

- APEX - Event Horizon Telescope

The Astrophysical Journal Letters, 875:L1 (17pp), 2019 April 10 https://doi.org/10.3847/2041-8213/ab0ec7

First M87 Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole

The Event Horizon Telescope Collaboration
(See the end matter for the full list of authors.)
Received 2019 March 1; revised 2019 March 12; accepted 2019 March 12; published 2019 April 10



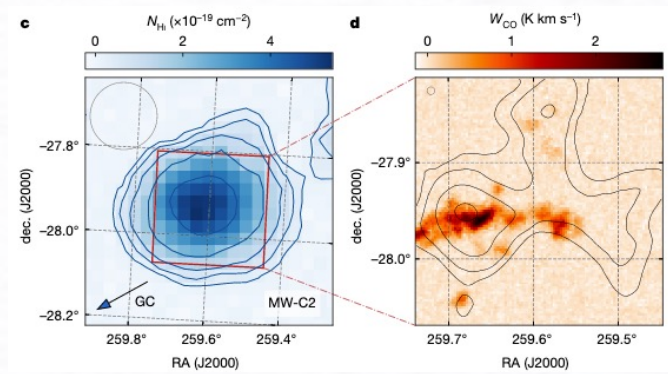
- Publications in NATURE

Article | Published: 19 August 2020

Cold gas in the Milky Way's nuclear wind

Enrico M. Di Teodoro, N. M. McClure-Griffiths, Felix J. Lockman & Lucia Armillotta

Nature **584**, 364–367 (2020) | Cite this article

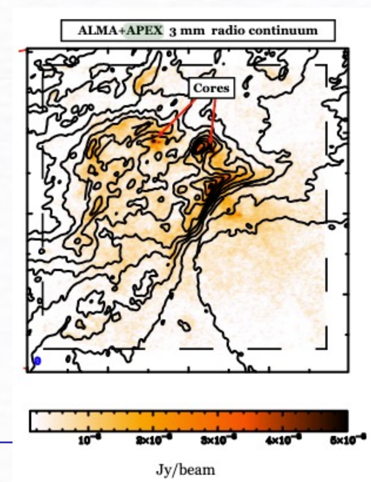


- ALMA+APEX data

The Carina Nebula and Gum 31 Molecular Complex. III. The Distribution of the 1–3 GHz Radio Continuum across the Whole Nebula

David Rebolledo[1,2], Anne J. Green[3], Michael G. Burton[4,5], Shari L. Breen[6], and Guido Garay[7]

Published 2021 March 9 •
The Astrophysical Journal, Volume 909, Number 1
Citation David Rebolledo *et al* 2021 *ApJ* **909** 93



Chilean projects

- **83* proposals accepted during the last 8 observing periods 2017B-2021B**
  (*2020A obs. were cancelled)
- **17 proposals presented by students**

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **487**, 1259–1268 (2019) doi:10.1093/mnras/stz1340
Advance Access publication 2019 May 16

Large-scale periodic velocity oscillation in the filamentary cloud G350.54+0.69

Hong-Li Liu[1,2,3]★ Amelia Stutz[3,4]★ and Jing-Hua Yuan[5]
[1] *Chinese Academy of Sciences South America Center for Astronomy, China-Chile Joint Center for Astronomy, Camino El Observatorio #1515, Las Condes, Santiago, Chile*
[2] *Department of Physics, The Chinese University of Hong Kong, Shatin, NT, Hon*
[3] *Departamento de Astronomía, Universidad de Concepción, Av. Esteban Iturra*
[4] *Max-Planck-Institute for Astronomy, Königstuhl 17, D-69117 Heidelberg, Ger*
[5] *National Astronomical Observatories, Chinese Academy of Sciences, 20A Datu*

Accepted 2019 May 7. Received 2019 May 2; in original form 2018 December

ABSTRACT
We use APEX mapping obser
kinematics of the filamentary
G350.5-N and G350.5-S. G350
We find a large-scale periodic
a wavelength of ~1.3 pc and a
instability-induced core format
could be driven by a combi
scale periodic physical oscilla
magnetohydrodynamic transve
polarization measurements.

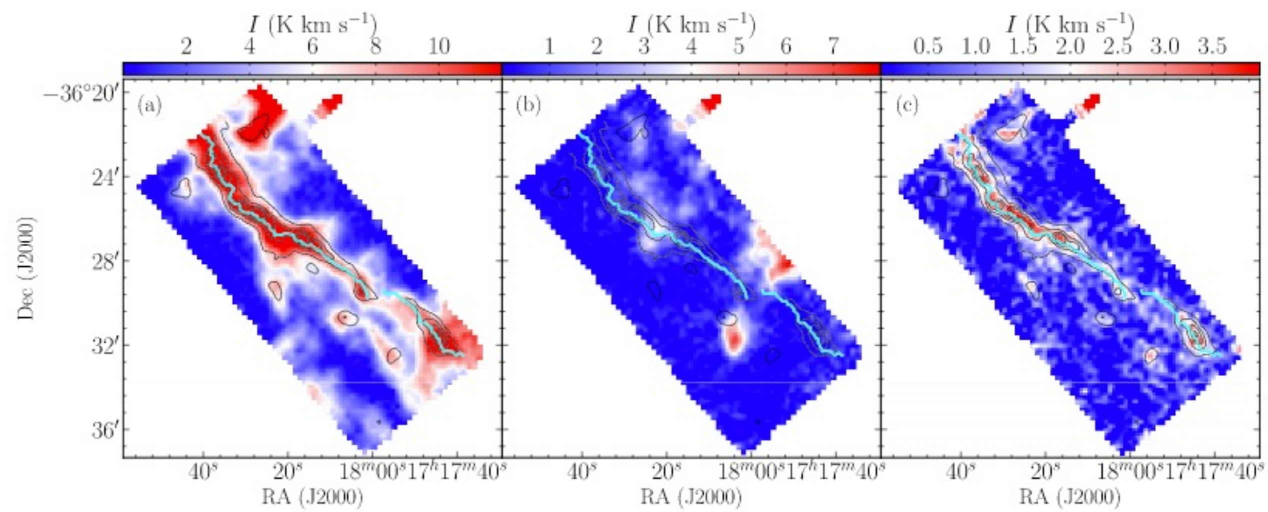


Figure 2. (a–b): Velocity-integrated intensity maps of the two velocity components of ^{13}CO (2-1) towards G350.5, the major one from −5.7 to −2 km s^{-1}, and the weak-emission one from −9 to −5.7 km s^{-1}. (c): Velocity-integrated intensity of C^{18}O (2-1), integrated over −7 to −1 km s^{-1}. The pixel size of the three maps is reduced to 7 arcsec, a quarter of the beam size, for a better visualization. The cyan curves in all panels represent the spines of the two discontinuous filaments as identified in Paper I and the black contours stand for the N_{H_2} column density (see Paper I), starting from 1.8 × 10^{22} cm^{-2} with a step of 0.6 × 10^{22} cm^{-2} (σ = 0.04 × 10^{22} cm^{-2}).

Chilean projects: astrochemistry

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **489**, 1519–1532 (2019) doi:10.1093/mnras/stz2087
Advance Access publication 2019 July 31

Cyanoacetylene in the outflow/hot molecular core G331.512−0.103

N. U. Duronea,[1★] L. Bronfman,[2] E. Mendoza,[3] M. Merello,[3] R. Finger,[2] N. Reyes,[2,4] C. Hervías-Caimapo,[5] A. Faure,[6] C. E. Cappa,[7] E. M. Arnal,[7] J. R. D. Lépine,[3] I. Kleiner[8] and L-Å. Nyman[9]

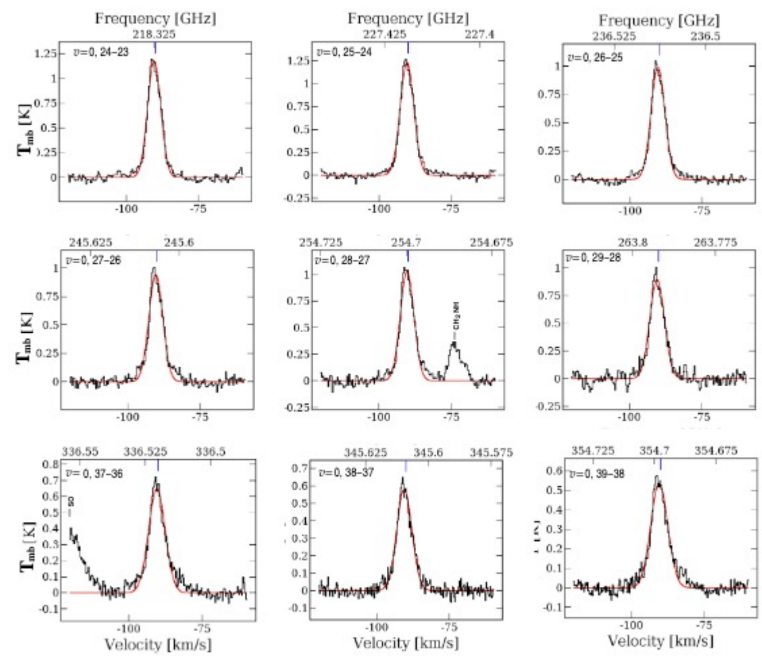


Figure 2. Observed spectra of the detected lines of HC_3N in the ground vibrational state v=0. The red curves show the gaussian fit to the lines. The transitions are indicated in the top left corner of each panel . The blue line at the top of the spectra indicate the rest frequency of each transition.

Chilean projects: extra-Galactic

- M. T. Valdivia. - Master thesis – U. de Chile
“Molecular Clouds in Extreme Environments of the Low-Metallicity Magellanic System”

A&A 641, A97 (2020)

ALMA resolves molecular clouds in metal-poor Magellanic Bridge A★

M. T. Valdivia-Mena[1], M. Rubio[1], A. D. Bolatto[2], H. P. Saldaño[3] and C. Verdugo[4]

-

[1] Departamento de Astronomía, Universidad de Chile, Santiago, Chile
e-mail: maria.valdivia@ug.uchile.cl
[2] University of Maryland, MD, USA
[3] Observatorio Astronómico de Córdoba, UNC, Argentina
[4] Joint Alma Observatory (JAO), Alonso de Córdova 3107, Vitacura, Santiago, Chile

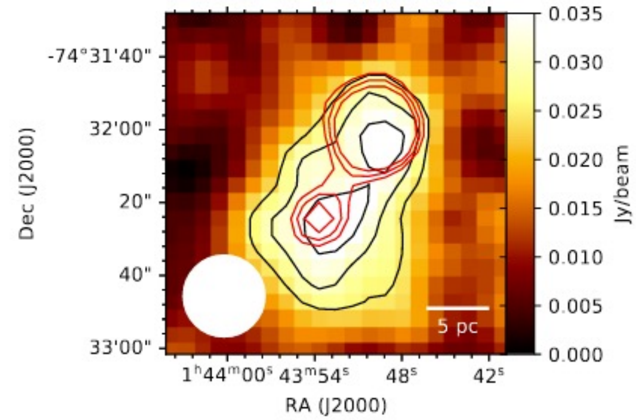


Fig. 6. LABOCA continuum image at 870 μm with black contours placed at 25, 30 and 35 mJy/beam, as in Figure 3. The white circle represents the beam size (beam FWHM= 22″). Red contours correspond to the ALMA and APEX CO(2–1) combined line emission convolved to the APEX resolution of 22″, integrated between 172 and 176 km s^{-1}, at 5σ, 6σ and 7σ, where σ is the rms of the integrated image (σ = 1.8 Jy $beam^{-1}$ km s^{-1}). The scalebar at the lower right corner represents a 5 pc length.

A&A 628, A23 (2019)
https://doi.org/10.1051/0004-6361/201935308

Astronomy & Astrophysics

Imaging the molecular interstellar medium in a gravitationally lensed star-forming galaxy at $z = 5.7$★

Yordanka Apostolovski[1,2], Manuel Aravena[3], Timo Anguita[1,2], Justin Spilker[4], Axel Weiß[5], Matthieu Béthermin[6], Scott C. Chapman[7], Chian-Chou Chen[8], Daniel Cunningham[7,9], Carlos De Breuck[8], Chenxing Dong[10], Christopher C. Hayward[11], Yashar Hezaveh[11,17], Sreevani Jarugula[12], Katrina Litke[13], Jingzhe Ma[14], Daniel P. Marrone[13], Desika Narayanan[10,15,16], Cassie A. Reuter[12], Kaja Rotermund[7], and Joaquin Vieira[12]

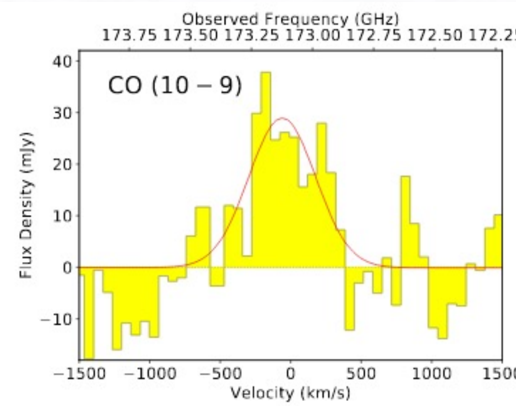
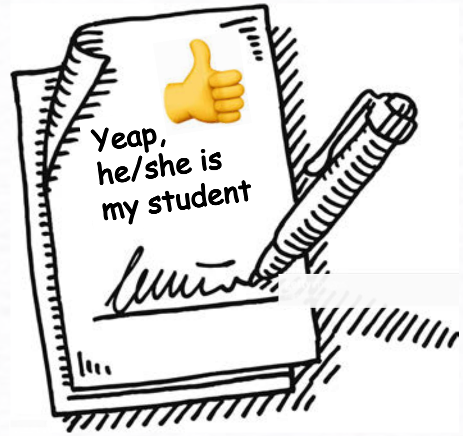


Fig. 3. Spectrum of the CO(10–9) line emission observed with APEX of SPT 0346-52. The red solid curve shows a Gaussian fit to the line profile. This line is about two times stonger than that of CO(9–8), suggesting contamination by a neighboring emission line.

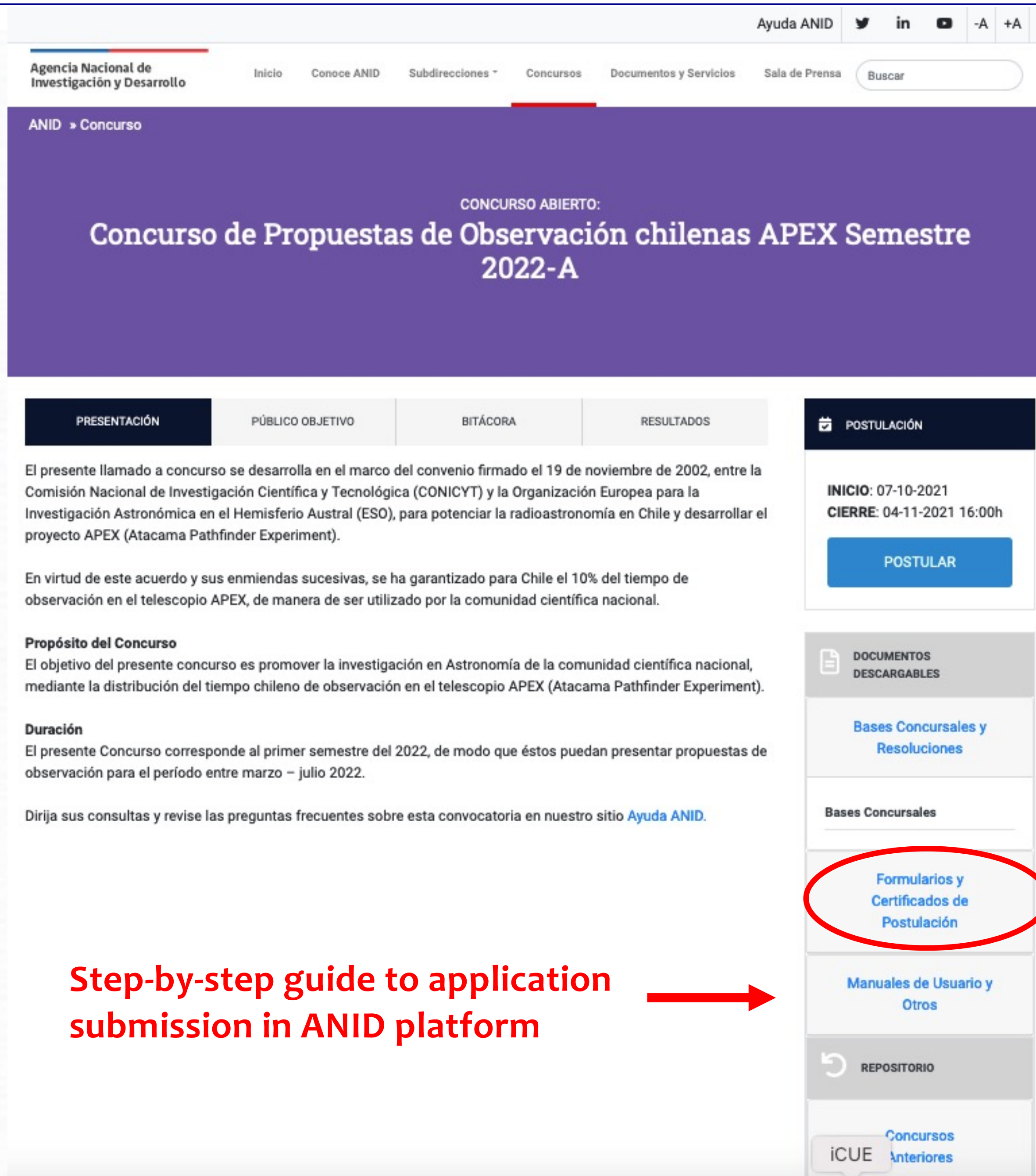
Planning proposals

- Proposal template and "Bases de concurso" are located at the ANID platform:
  https://www.anid.cl/concursos/
- **Deadline: October 4th, 4 pm CLT.**
- Submission time is checked
- PI names are reviewed and their corresponding institution is checked. If doubts, the SOCHIAS "White List" is checked.
- **Letter from supervisor is required in case that PI is a student.**
- **If you are applying for observing time with a Private Instrument, an approval letter is needed from the PI of that instrument.**



TAC Review

- Committee: 7 members.
- Proposals graded from 1 (min) to 5 (max).
- **Projects with final grades below 3 are not allocated with time.**
- Proposals are then ranked, a report of weakness and strengths is prepared for each one.
- PIs of accepted proposals are contacted later for preparation of phase 2 (setup of scripts for telescope observations) .



Ayuda ANID | -A | +A

Agencia Nacional de Investigación y Desarrollo

Inicio | Conoce ANID | Subdirecciones | Concursos | Documentos y Servicios | Sala de Prensa | Buscar

ANID » Concurso

CONCURSO ABIERTO:

Concurso de Propuestas de Observación chilenas APEX Semestre 2022-A

PRESENTACIÓN | PÚBLICO OBJETIVO | BITÁCORA | RESULTADOS

El presente llamado a concurso se desarrolla en el marco del convenio firmado el 19 de noviembre de 2002, entre la Comisión Nacional de Investigación Científica y Tecnológica (CONICYT) y la Organización Europea para la Investigación Astronómica en el Hemisferio Austral (ESO), para potenciar la radioastronomía en Chile y desarrollar el proyecto APEX (Atacama Pathfinder Experiment).

En virtud de este acuerdo y sus enmiendas sucesivas, se ha garantizado para Chile el 10% del tiempo de observación en el telescopio APEX, de manera de ser utilizado por la comunidad científica nacional.

Propósito del Concurso
El objetivo del presente concurso es promover la investigación en Astronomía de la comunidad científica nacional, mediante la distribución del tiempo chileno de observación en el telescopio APEX (Atacama Pathfinder Experiment).

Duración
El presente Concurso corresponde al primer semestre del 2022, de modo que éstos puedan presentar propuestas de observación para el período entre marzo – julio 2022.

Dirija sus consultas y revise las preguntas frecuentes sobre esta convocatoria en nuestro sitio Ayuda ANID.

POSTULACIÓN

INICIO: 07-10-2021
CIERRE: 04-11-2021 16:00h

POSTULAR

DOCUMENTOS DESCARGABLES

Bases Concursales y Resoluciones

Bases Concursales

Formularios y Certificados de Postulación

Manuales de Usuario y Otros

REPOSITORIO

Concursos Anteriores

iCUE

Application form

Step-by-step guide to application submission in ANID platform

REM:

CHILEAN APEX TELESCOPE TAC

Prop. #:

Proposal for observations — **Semester 2022-A**

Submit files at `https://auth.anid.cl/` — **Category: Radio**

1. Title

Proposal for Observing Time in APEX by a Member of the Chilean Astronomical Community.

2. Abstract

Provide a concise summary of your proposal. You can use this form to apply for time on any of the APEX instruments.
Each proposal should contain a specific scientific project. If you have more than one project, then you should submit one separate proposal for each.
IMPORTANT: Students (S) must attach the support letter from their supervisor. Visiting researchers (V) must attach the letter from their host Chilean institution. If you are requesting time for a Private Instrument, an approval letter from the PI of such instrument should be attached. For further detail see the Terms of Reference for this call (Bases concursales in Spanish).
THE SUBMITTED PDF FILE MUST BE IN LETTER FORMAT. FILES SUBMITTED IN A4 OR ANY OTHER FORMATS WILL NOT BE ACCEPTED

Abstract of your proposal

3. Principal investigator — **Status (A,S,V):** S

Your Info

◁ **Name** B. Juarez
e-mail bjuarez@ichile.cl
Phone 2-100-10000
Institute Instituto Chileno de Historia de la Astronomía
Address 785-9083 Estación Central, Santiago, Chile

4. Co-investigators (names and institutions)

A. Mariscal (Univ. San Clemente, Chile)
R. M. Solares (Univ. D. Marcoleta, Chile)
D. Torres (Univ. San Camilo, Chile
M. Rodriguez (Til-Til, Chile)
J. M. Fernández (Catedral de Santiago, Chile)
◁ J. de la Barrera (Universidad de Valdivia, Chile)
F. Madero (Academia de Ciencias, Chile)

5a. Number of hours requested on the APEX telescope XXX

5b. Instrument(s) requested and hours (in each one)

Facility Instruments

	180	345	660
SEPIA:	X	X	X

	230	460
nFLASH:	X	X

Private Instruments

ArTeMiS:	X
CONCERTO:	X
OTHER:	X

Requested hrs

6a. Preferred months

first choice: July — second choice: Sep/Oct

6b. Other scheduling constraints

7. Past and future of this project

i) Time already awarded to this project:
ii) Time required to complete this project:

1.

8. Description of the programme (1 page of text + up to 2 pages for references, tables and figures.)

A) Scientific rationale Describe the scientific context of the research that you intend to carry out using APEX observing time. Make sure to provide a succinct, up-to-date review of the relevant literature, and to discuss the broader scientific implications of your proposed science.

B) Scientific aim Explain what exactly your team proposes to accomplish with the requested observations. Describe the reduction and analysis tools that you will use, and the scientific return expected.

Science rationale

+

Scientific aim

1 page !!

2.

Description of strategy and requested hours

9. Observational strategy and justification of requested time (please take into account overheads).

To estimate your exposure times, you are encouraged to check the Observing Time Calculator tool for the instrument(s) you are going to use that are available at the observatory web page http://www.apex-telescope.org/ns/observing-time-calculators/

If you intend to do an On-The-Fly mapping, you can use the web following page to design the OTF maps: http://www.apex-telescope.org/heterodyne/calculator/ns/otf/index.php

PLEASE MAKE SURE ALL THE TIMES REQUESTED ARE CONSISTENT THROUGHOUT THE PROPOSAL: TOTAL NUMBER OF HOURS (BOX 5A), HOURS PER INSTRUMENT (BOXES ON 5B) AND THE JUSTIFICATION FOR THE REQUESTED TIME (THIS BOX 9)

Please put in page 3a (and 3b if necessary) the SCREENSHOT(S) OF THE OBSERVING TIME CALCULATOR(S), with the values you used to calculate the requested observing time. One screenshot for each instrument you are proposing to use. Also, we recommend to copy here the text given at the OTC page with your requested observing time, e.g.:

"We have used the ON-OFF observing time calculator at APEX V7.2 to estimate the total time needed to achieve our goal. Using NFLASH230 tuned to 231 GHz in the LSB, selecting a spectral resolution of 0.0793 km/s and assuming a typical source elevation of 45 deg and a typical PWV of 2 mm, we could get down to a noise of 100 mK[Ta*] in 2.8 minutes (including telescope and calibration overheads)."

10. List of targets (note that the absence of a proper object list and information will weaken your proposal).

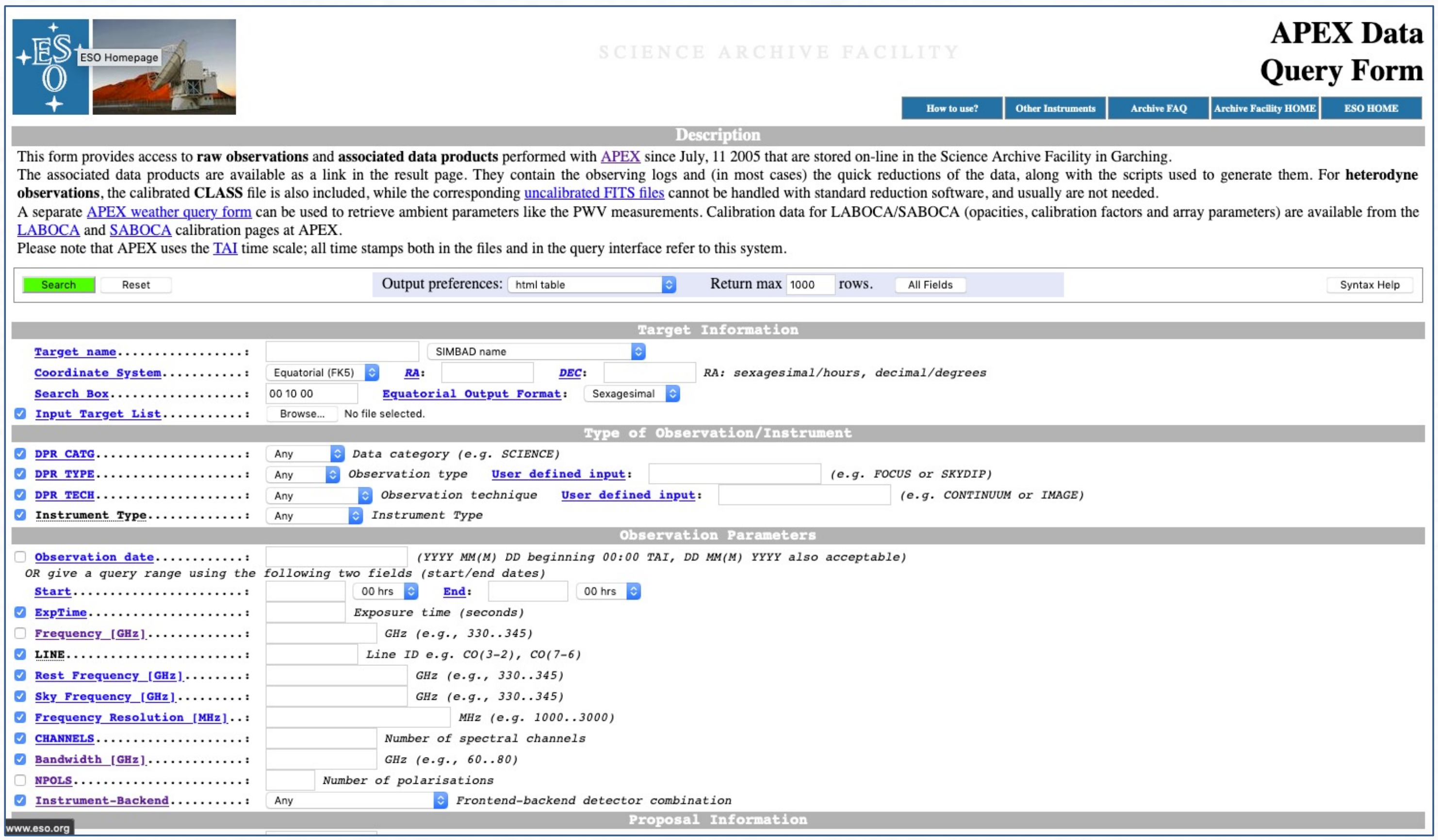
Name	α	δ	Epoch	Mag.	Additional Information
HD 177482	21 08 46.85	-88 57 23.40	J2000	V=5.42	Closest star to the south celestial pole

List of targets

3.

Planning proposals: Tips

- Check the ESO APEX archive in order to not duplicate observations
  http://archive.eso.org/wdb/wdb/eso/apex/form



Planning proposals: Tips

- Check the ESO APEX archive in order to not duplicate observations
  http://archive.eso.org/wdb/wdb/eso/apex/form
- APEX Chilean TAC is composed by 7 members that stay in the committee for 2 years or more. This means that there is memory of past proposals.
  If the TAC give you feedback, you should address those comments.
- If the proposal is a continuation of a previous proposal, it is a good idea to show results already obtained in that project.
- Use the tools given in the APEX webpage (Kalle's talk):
  - For Spectral setup: http://www.apex-telescope.org/ns/instrument-setup-tool/
  - For estimation of observing time, under different instruments (heterodyne receiver or bolometer camera) and observing mode (ON/OFF or On-The-Fly map): http://www.apex-telescope.org/ns/observing-time-calculators/
- Respect the spaces given by the different sections of the proposal LaTeX template. Do not modify margins and font sizes.
- Don't forget the support letters. They must be included in the online application.

Planning proposals: Tips

Weather

The precipitable water vapour (PWV) is the crucial parameter that determines the atmospheric transparency for sub-millimetre observations. At the APEX site on Llano de Chajnantor the amount of PWV is typically 1.0 mm and falls below 0.5 mm up to 25% of the time.

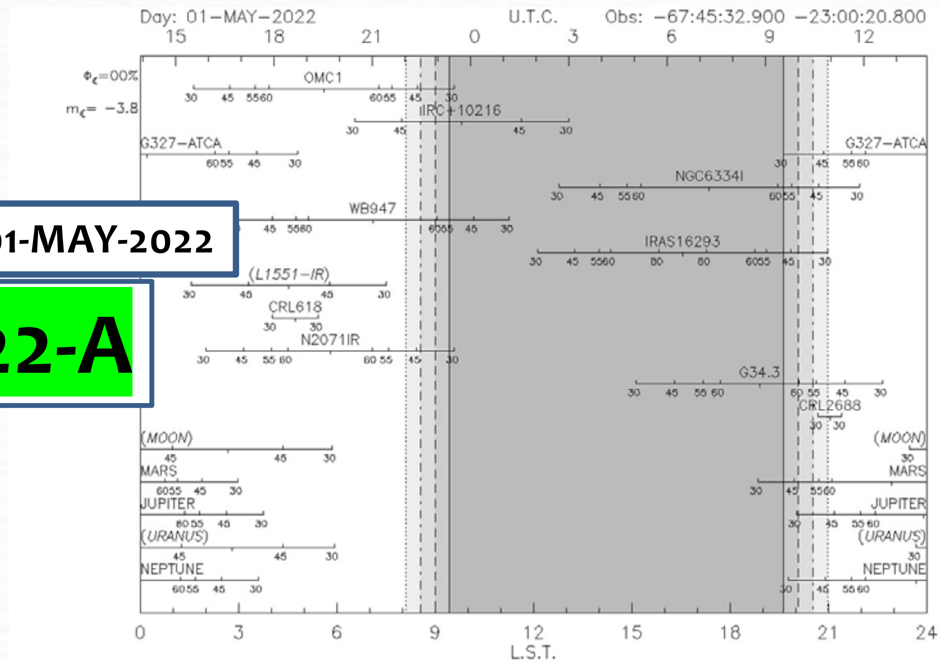
- In general, low frequency instruments (SEPIA180, nFLASH230) can be used with "fair" weather conditions: PWV > 1.5 mm H2O.
- High freq. instruments required better weather conditions:
  e.g. PWV ~ 1.0 mm H20 for SEPIA345;
  ~ 0.5 mm H2O for ArTéMiS, nFLASH460, SEPIA660.
- As general rule, winter observations (Mar - Jul) have better weather conditions than summer runs (Aug - Dec).

Planning proposals: Tips

- Plan your observations, according to the LST of your targets.
- Even if you have high rank and good weather, you may not get your observations due to sun avoidance or low elevation.
- Consider that observable LST during night change from winter to summer observation runs.
- Recommendation: **use ASTRO from GILDAS package.**

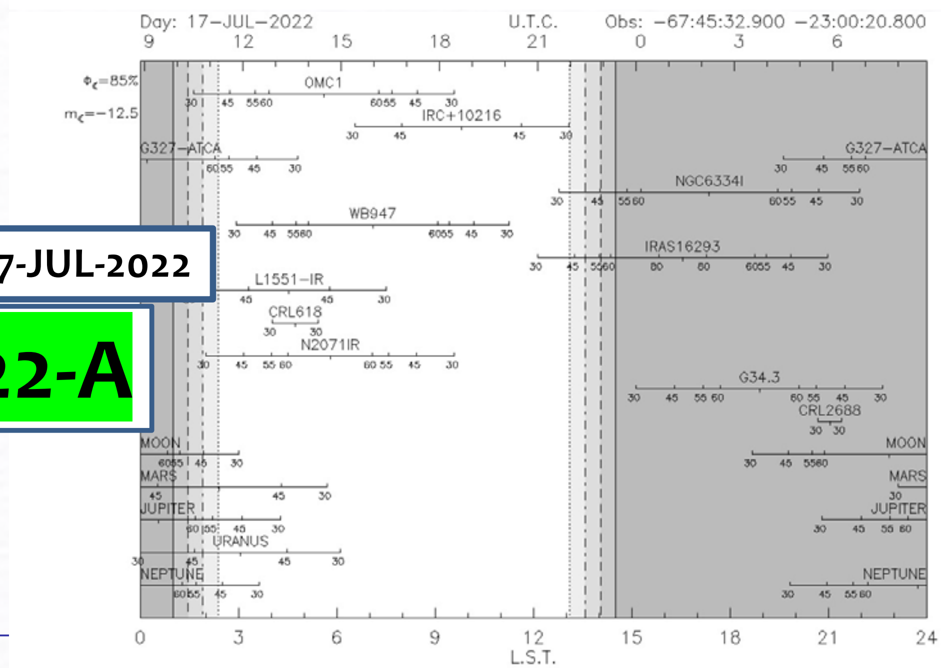
DAY: 01-MAY-2022

2022-A



DAY: 17-JUL-2022

2022-A



Planning proposals: Tips

- Syntax for source catalogs for ASTRO (velocities are not necessary in this case)

Source catalogs

APEX source catalogs have the suffix `.cat`, and their format should follow those for the IRAM PdB source catalogs. Comment lines (or comment part of source lines) are preceded by a "!" or "#". Empty lines don't have any effect. A source line will contain source name, coordinate system (EQ or HO), epoch, RA (h:m:s), Dec (d:m:s), velocity frame (currently only LSR is supported), velocity value, and (maybe) comments. The individual fields are separated by one or more spaces (und hence should not contain any spaces...). Thus the catalog syntax looks like the following:

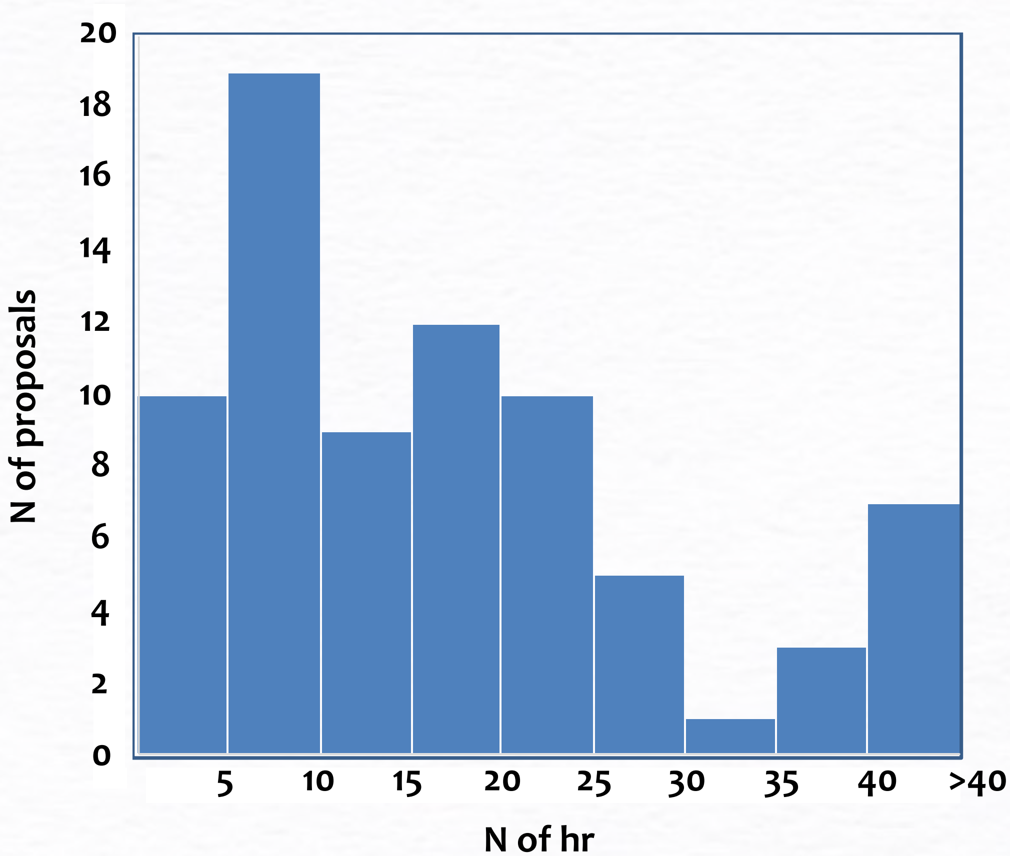
```
! This is a source catalog for APEX

R-And      EQ 2000  00:24:01.939   38:34:37.12   LSR -15.0  !  Pointing source
R-For      EQ 2000  02:29:15.312  -26:05:55.71   LSR  -1.5  !  Another one ...
```

Currently, the only possible coordinate systems are equatorial (EQ) with equinox J2000 or horizontal (HO).
The source name must not be longer than 12 characters, because of limitations in the Gildas data reduction software. It must further not contain any spaces, "!", "#", "|" or other special characters. Allowed are A-Z, a-z, 0-9, [,], (,), -, and _

Planning proposals: Tips

- Histogram of approved hours 2017B-2021A



- There is not a restriction in the number of hours to apply.
- In general, projects requiring ~20 hrs or less are more likely to be completed in a single run.
- Projects not finished during a semester does not pass automatically to the next semester (they lose their priority, ”filler” status).
- To consider:

  Does the success of your project depend on obtaining 100% of the requested hours?
  What about if 80% or 70% of the requested time or targets are observed?

Summary

- APEX call for Chilean projects is open with **deadline on Thursday, October 4th, 4pm CLT**.
- Heterodyne receivers SEPIA180, SEPIA345, SEPIA660 and nFLASH offered as facility instruments. ArTéMiS and CONCERTO are PI instruments and requires approval letter.
- For 2022-A, it is likely that 24 hrs observations will be offered.
- For preparing your proposal, consider the tools from APEX website (spectral setup and time integrator). Also consider if the LST range of your targets is favorable for the semester you are applying.