

APEX the last chance

Carlos De Breuck

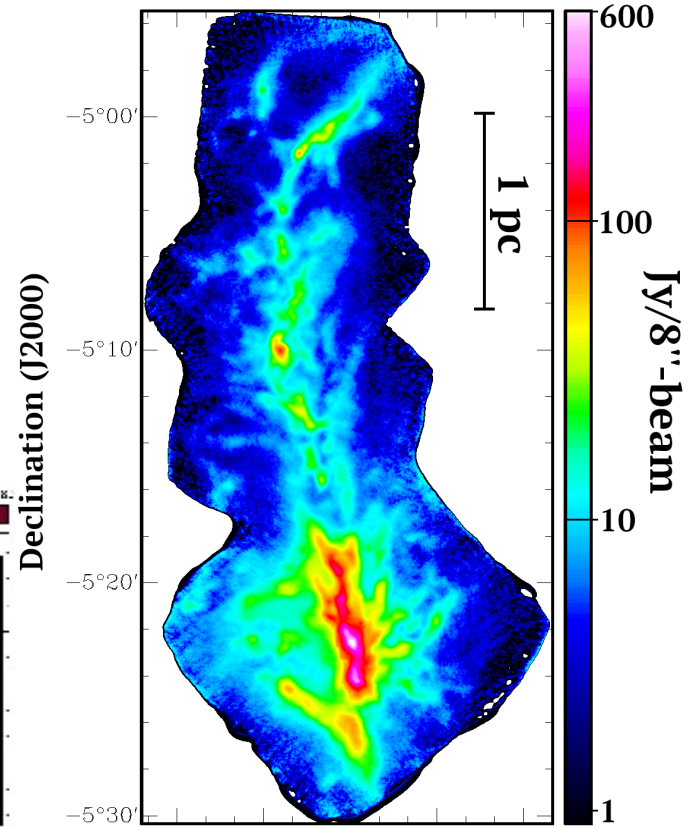
La Silla Paranal Users workshop P110,
11 March 2022

Recent APEX science results



CO(2-1) in Orion
Supercam
Stanke et al. 2022

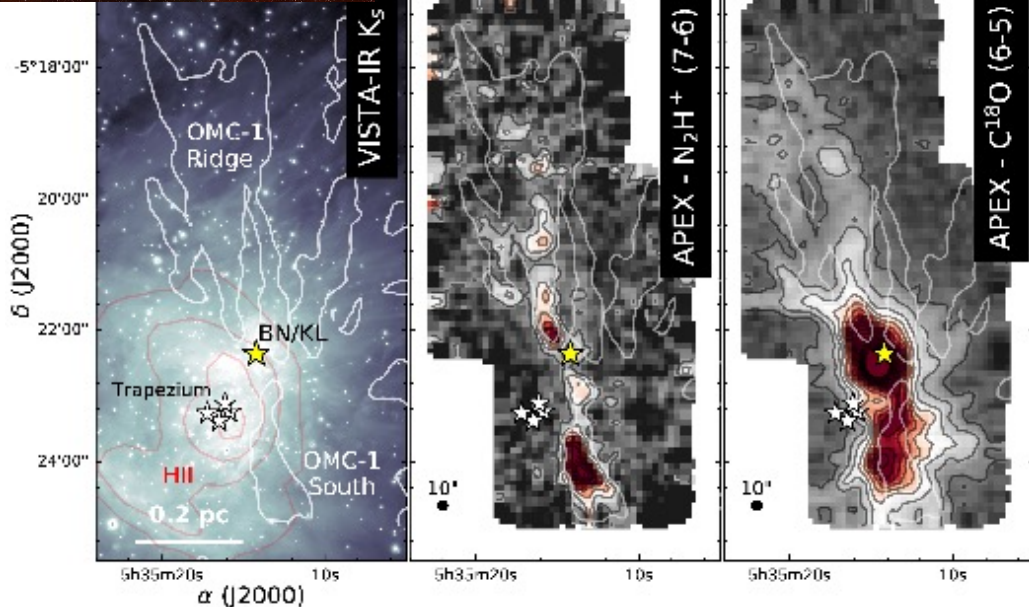
N₂H+(7-6) in Orion
SEPIA660
Hacar et al. 2019



Declination (J2000)

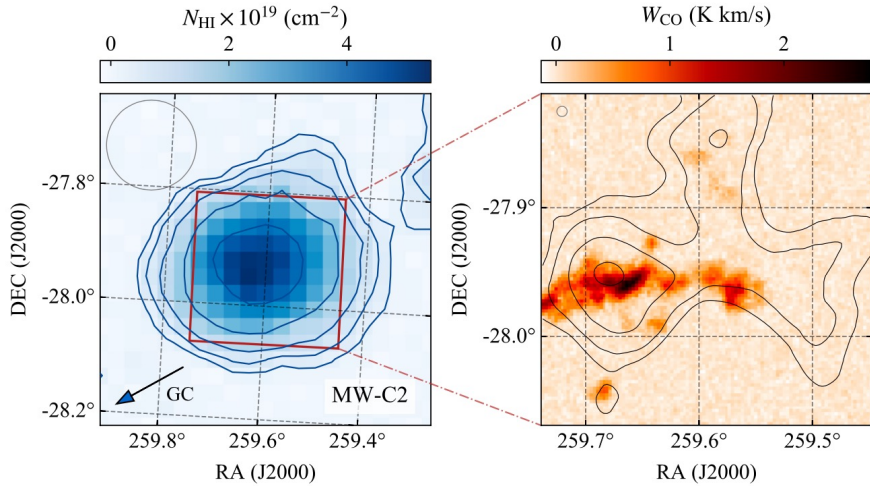
Right Ascension (J2000)

350 μ m filaments
ArTéMiS
Schuller et al. 2020



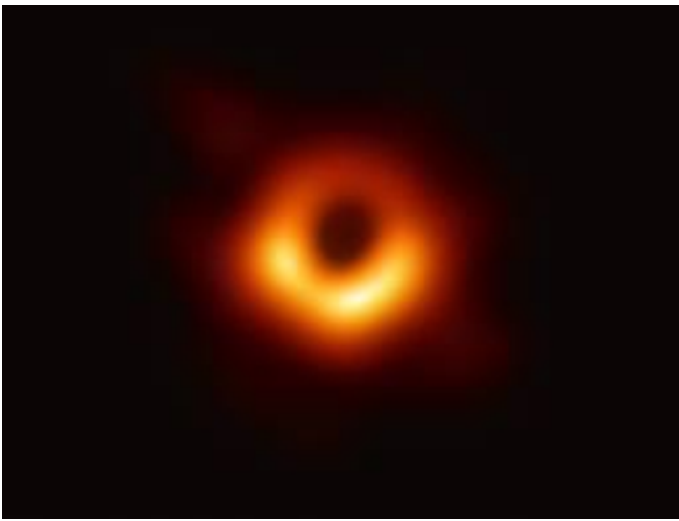
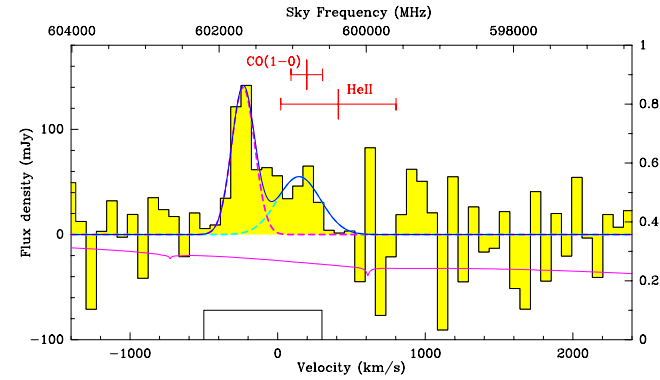


Recent APEX science results



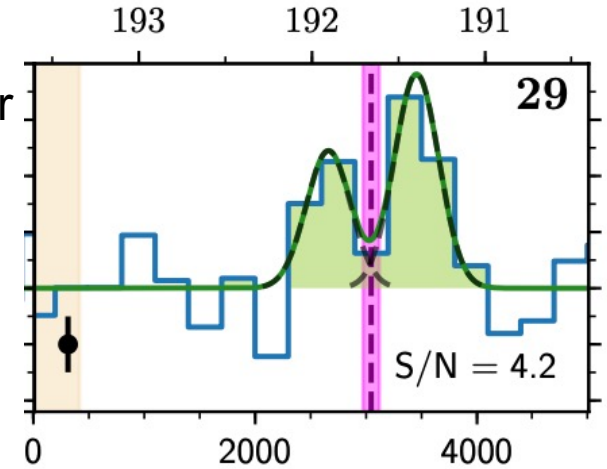
CO(2-1) Galactic outflows
nFLASH230
Di Teodoro et al. 2019

[CII] in Spiderweb z=2.1
SEPIA660
De Breuck et al. 2022



CO(7-6) & [CI] in z=3 quasar
SEPIA180
Muños Elguietta et al. 2022

EHT M87 image
nFLASH230





The APEX telescope collaboration

- APEX is an ALMA prototype antenna adapted for single-dish use (e.g. adding Nasmyth cabins)
- Max Planck, ESO, Swedish and Chilean time evaluated by independent time allocation committees
- In operation since September 2005, offered since ESO P77
- Oversubscription factor on ESO time between 2:1 and 5:1
- Initial agreement ran till 2012, extended till 2015, 2017, 2022
- Telescope had a major overhaul end of 2017, replacing M1 panels, entire M2 structure, engines
- Current agreement ends on 31 December 2022



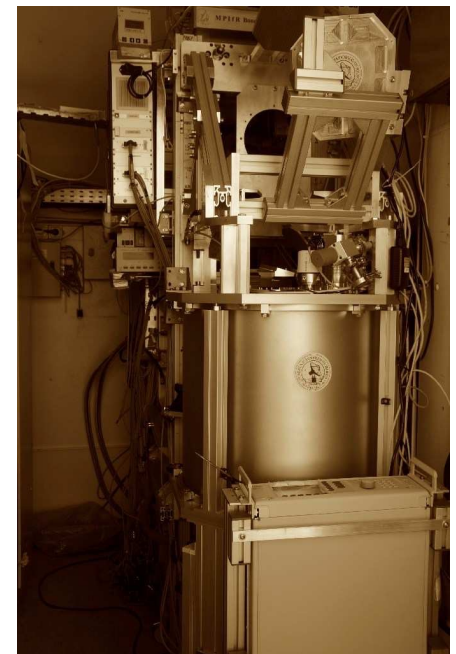
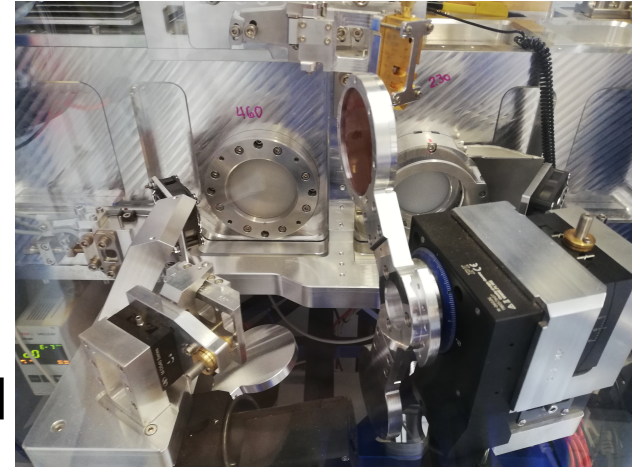


APEX operations beyond 2022

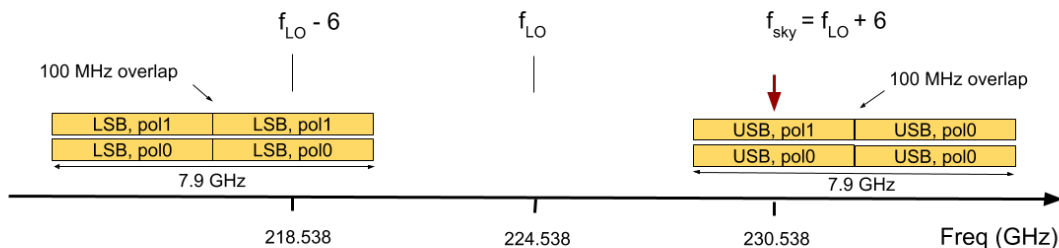
- ESO will operate APEX for MPIfR in 2023-2025 as a hosted telescope, cost-neutral to ESO, with no ESO observing time
- **Last ESO call for APEX proposals in P110:**
 - regular deadline on 25 March 2022
 - DDT proposals till December 2022
- MPIfR time will remain open to scientists in German institutes, and Chile will maintain its 10% of observing time
- Beyond 2022, new APEX data from the remaining partners will no longer be stored in the ESO archive

APEX facility instruments

- nFLASH simultaneously covering 196-281 GHz and 378-507 GHz
- **New:** dual colour mode now available!
- nFLASH230 can be used up to PWV ~5mm, proposals for PWV>3mm up to 199h accepted
- SEPIA receivers individually covering 157-211 GHz, 272-376 GHz and 578-738 GHz
- Both instruments allow to record both sidebands with 4 or 8 GHz bandwidth and a spectral resolution of 60 kHz



Example of tuning CO(2-1) USB @ 230.538 GHz



LASMA PI instrument

- LASMA is a 7-pixel receiver covering 268 to 375 GHz
- Now covers 8 GHz in both sidebands, which allows to simultaneously observe $^{13}\text{CO}(3-2)$ and $^{12}\text{CO}(3-2)$
- Good instrument for medium-large CO(3-2) mapping of relatively faint regions
- Needs collaboration with instrument team at MPIfR, contact Friedrich Wyrowski wyrowski@mpifr-bonn.mpg.de



Bolometer PI instruments

- ArTéMiS provides simultaneous 350 μ m & 450 μ m images in 4'x2' field of view
- Useful for mapping of bright star-forming regions
- CONCERTO provides ~1.5 GHz resolution spectra covering 120-310 GHz in 20' diameter field
- Designed for [CII] intensity mapping experiment, can also be used for S-Z, SF regions, etc



Hints for APEX P110

- Proposals should be self-contained, no carry-over or continuation possible in future periods
- Avoid RA = 10 ± 4 h, covered by CONCERTO large programme
- Collaboration with PI team is required for CONCERTO & LASMA
- Ideal range is $20\text{h} < \text{RA} < 4\text{h}$, which is much less oversubscribed
- Concentrate on unique science with APEX:
 - Wide-field imaging with CONCERTO & ArTéMiS
 - Frequency ranges outside of ALMA receivers:
 - 500-508 GHz
 - 578-602 GHz
 - 720-738 GHz
 - Single dish complements to existing ALMA data
- Keep in mind that most reviewers will not be APEX experts
- Distributed peer review proposal time limits also apply to APEX

APEX phase 3 data releases

- Fully reduced data from APEX is delivered to the ESO archive, available from the archive science portal <https://archive.eso.org/scienceportal/>
- APEX phase 3 data for 1D spectra, images, working on 3D cubes
- Ideal legacy data for total power combination with ALMA data
- Future ALMA ADP data may become available in the same interface

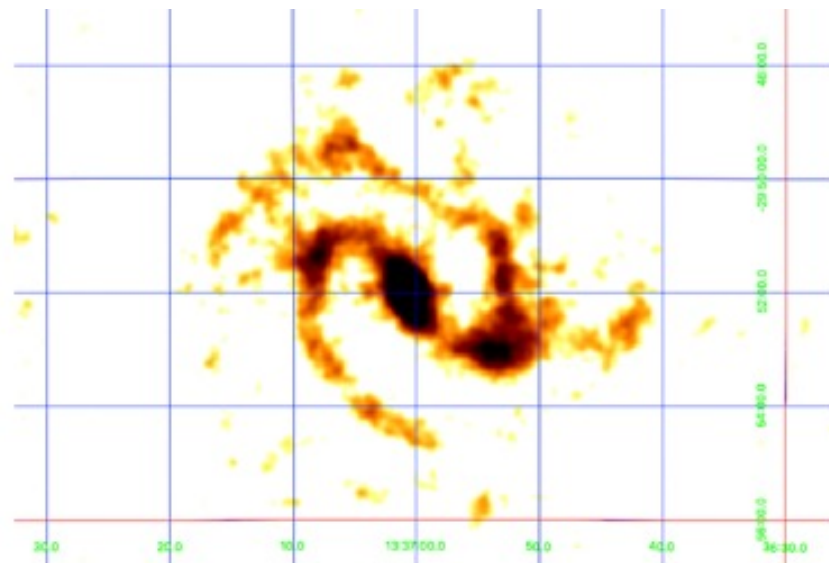
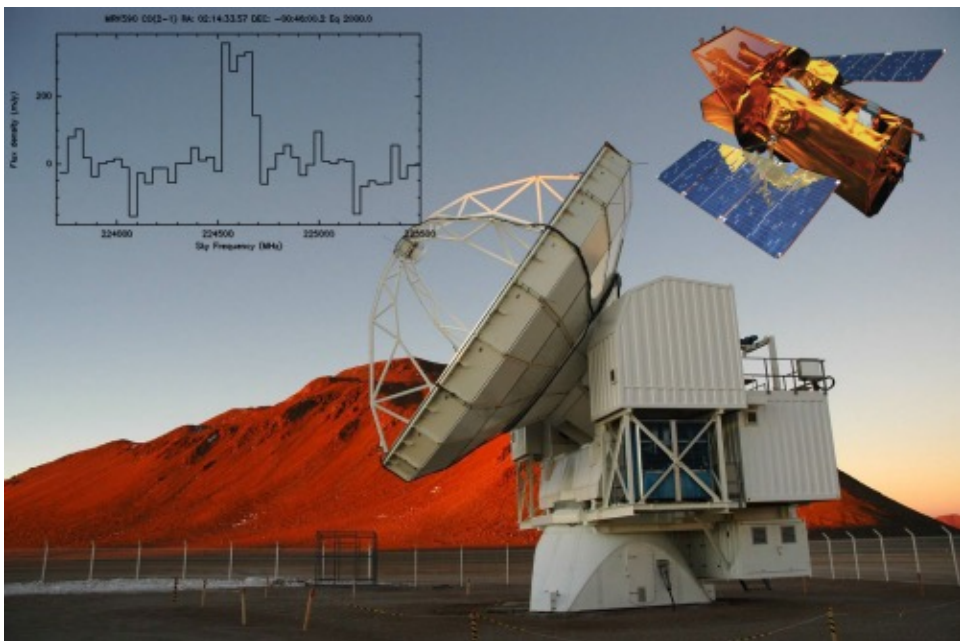


Figure 1: M83 in 870 μm continuum emission. Grey scale ranges from 10 mJy/beam (1 sigma) to 100 mJy/beam (10 sigma, black). At the nucleus the flux is 470 mJy/beam. Beam size is 20.3".