Development on the ALMA archive

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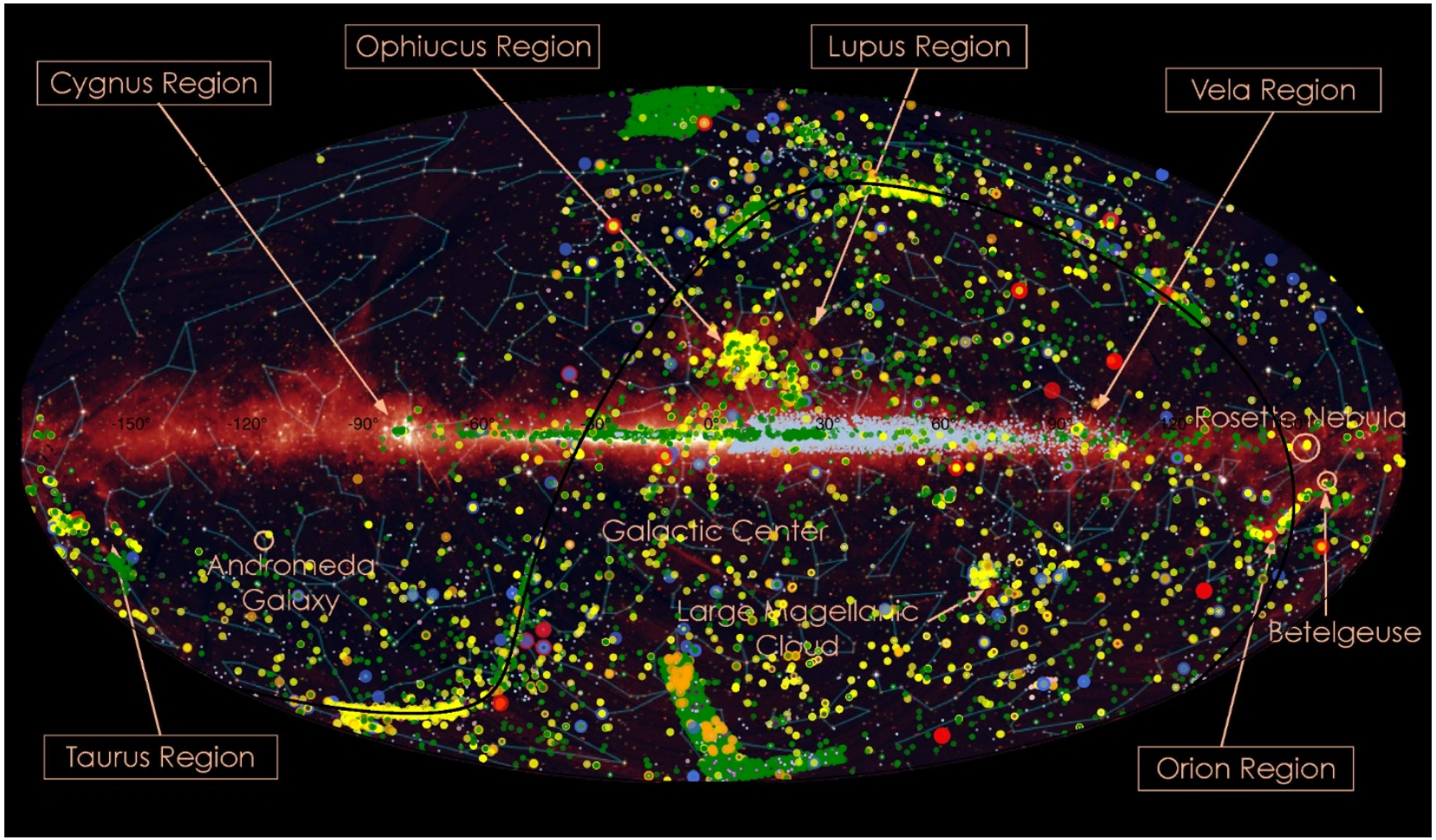
ALMA Science Archive

Over 83 000 science observations in the ASA

Distribution of 70k observations in the ASA

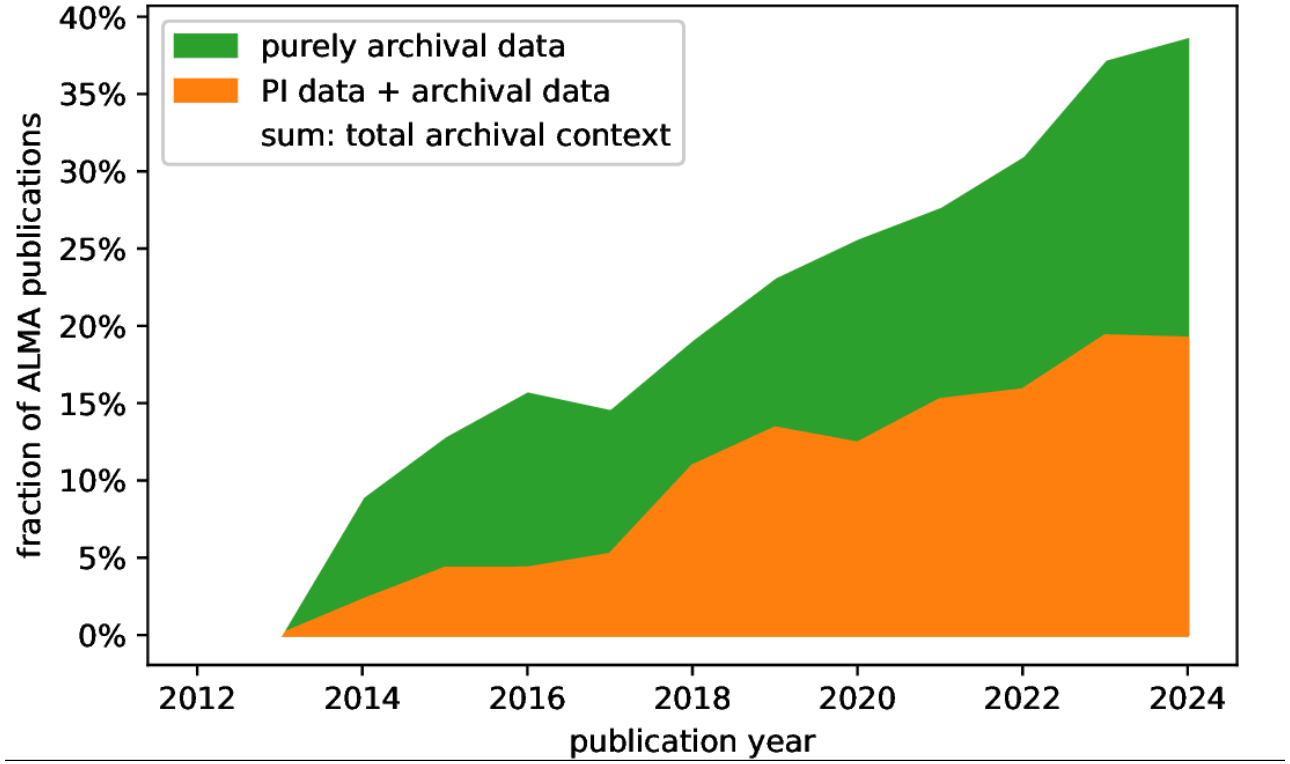


Band 3
Band 4
Band 5
Band 6
Band 7
Band 8
Band 9
Band 10

PY. Hsieh

Archival publications

Growing use of the Archive

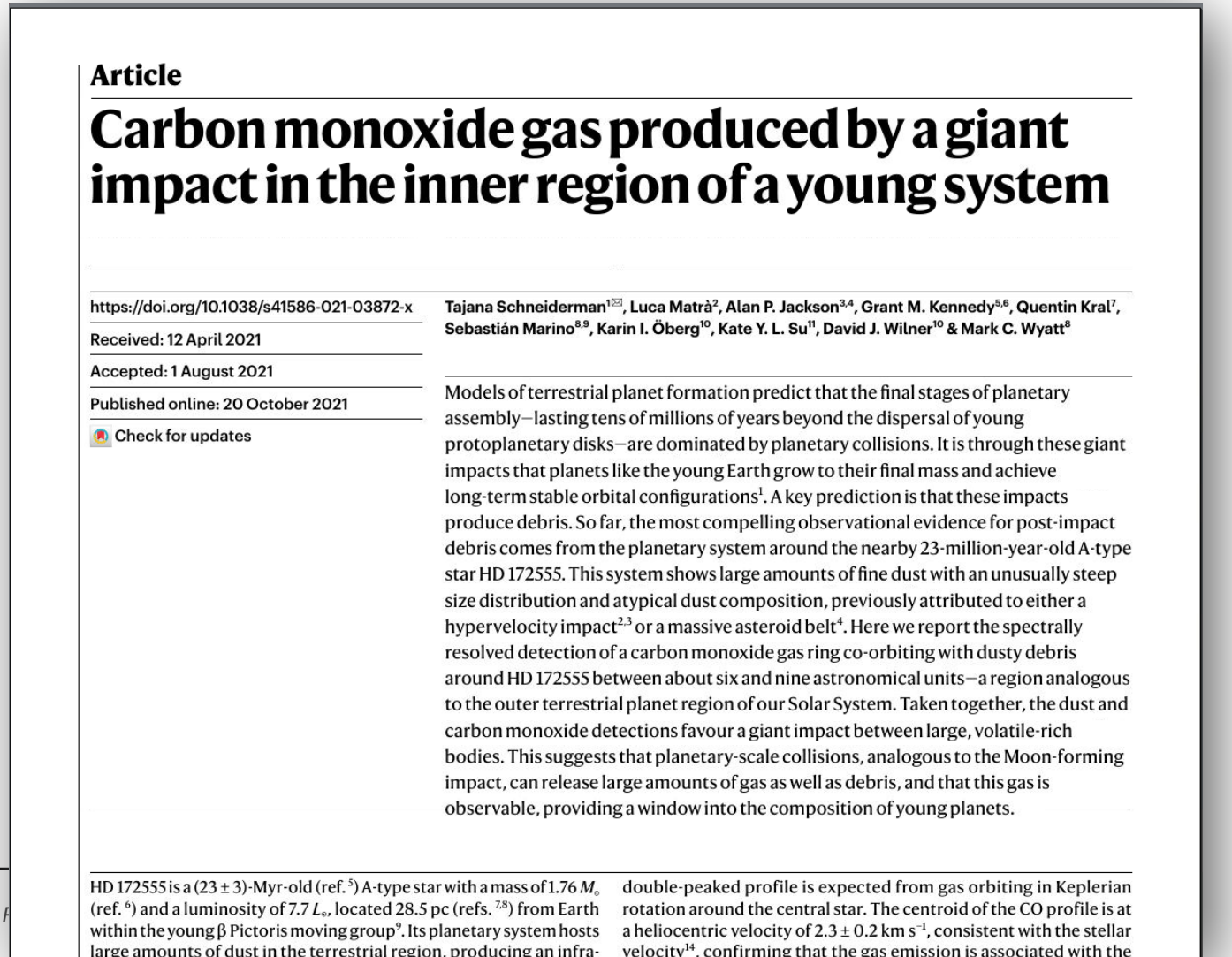


38.8% of all ALMA publications made use of archival data in 2024.

This is a very large number for ground-based PI facilities

Archival data is highly relevant

11 publications in Nature and Science make use of ALMA archival data



Article

Carbon monoxide gas produced by a giant impact in the inner region of a young system

https://doi.org/10.1038/s41586-021-03872-x

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Check for updates

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Models of terrestrial planet formation predict that the final stages of planetary assembly—lasting tens of millions of years beyond the dispersal of young protoplanetary disks—are dominated by planetary collisions. It is through these giant impacts that planets like the young Earth grow to their final mass and achieve long-term stable orbital configurations[1]. A key prediction is that these impacts produce debris. So far, the most compelling observational evidence for post-impact debris comes from the planetary system around the nearby 23-million-year-old A-type star HD 172555. This system shows large amounts of fine dust with an unusually steep size distribution and atypical dust composition, previously attributed to either a hypervelocity impact[2,3] or a massive asteroid belt[4]. Here we report the spectrally resolved detection of a carbon monoxide gas ring co-orbiting with dusty debris around HD 172555 between about six and nine astronomical units—a region analogous to the outer terrestrial planet region of our Solar System. Taken together, the dust and carbon monoxide detections favour a giant impact between large, volatile-rich bodies. This suggests that planetary-scale collisions, analogous to the Moon-forming impact, can release large amounts of gas as well as debris, and that this gas is observable, providing a window into the composition of young planets.

HD 172555 is a (23 ± 3)-Myr-old (ref. [5]) A-type star with a mass of 1.76 $M_{\odot}$ (ref. [6]) and a luminosity of 7.7 $L_{\odot}$, located 28.5 pc (refs. [7,8]) from Earth within the young β Pictoris moving group[9]. Its planetary system hosts large amounts of dust in the terrestrial region, producing an infra-

double-peaked profile is expected from gas orbiting in Keplerian rotation around the central star. The centroid of the CO profile is at a heliocentric velocity of 2.3 ± 0.2 km s^{-1}, consistent with the stellar velocity[14], confirming that the gas emission is associated with the

- 2021Natur.598..425S
- purely ALMA archival data from 2012.1

- Most popular data in all 2024 publications: Cycle 5!

ALMA Science Archive status

ALMA Science Archive version 1.0

ESO Messenger Article 2022

https://www.eso.org/sci/publications/messenger/archive/no.187-jun22/messenger-no187-25-30.pdf

Instrumentation

DOI: 10.18727/0722-6691/5267

The ALMA Science Archive Reaches a Major Milestone

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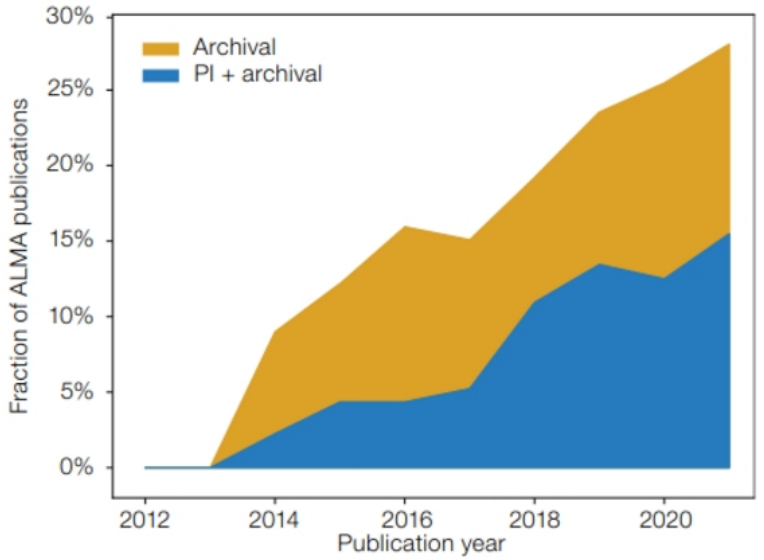

Figure 1. The fraction of ALMA publications with archival context (excluding Science Verification data) is shown as a function of the publication year. The fraction of publications making use of ALMA archival data together with proprietary PI data is shown in blue. Stacked on top is the fraction of publications making exclusive use of ALMA archival data, shown in yellow. Overall, the fraction of ALMA publications with archival context has been continually rising, reaching 28% in 2021.

user experience with the goal of helping

publications made use of archival data of

Some selected features

ALMA Science Archive version 1.0

- Object-type search
- Text-based proposal/project similarity using machine learning
- Interactive previews, including tentative line-identification
- One-click-CARTA remote visualization for all FITS files
- The background slider in the sky view
- Full set of VO-services (nearly 10M queries served)
- Jupyter Notebook tutorials
- ...

Context

Astronomy of the future

It is not good enough that scientists can do what they need to do.
They also have to be able to do it **fast**.

fastronomy

Let scientists concentrate on science

Short-term future

Short-term plans

Beyond ASA v1.0

- ALMA image morphology similarity
- Making metadata from ADMIT searchable
- Substantial work on the query and download interfaces
- Converting the three calMS services at the ARCs into official software and integrating them into the ASA
- Probably: reprocessing of the holdings of the Science Archive with the latest CASA/PL

Future development

ALMA2030 Archive Vision WG

WSU era

- ALMA2030 Roadmap:
  - An ALMA2030 Archive Vision WG should be formed to "… identify the functionality needed for the community to mine the ALMA archive efficiently, …"
  - "The ability to efficiently mine the archive contents is [...] vital for the community and ALMA's future."

    ALMA2030 Archive Vision WG to start early 2026

- Discussed but not approved nor funded
  - Online re-imaging, re-combination service
  - AI assistants
  - Science Platforms
  - ...

Now it is your turn!

ALMA Development Studies: the ALMA Science Archive

Archive related **studies** for reference:

- Metadata extraction pipeline (ADMIT) NA (became a project)
- ADMIT archive search NA
- Science Platform (ARCADE) NA
- Cycle 1-4 products (ARI-L) EU (became a project)

Questions?