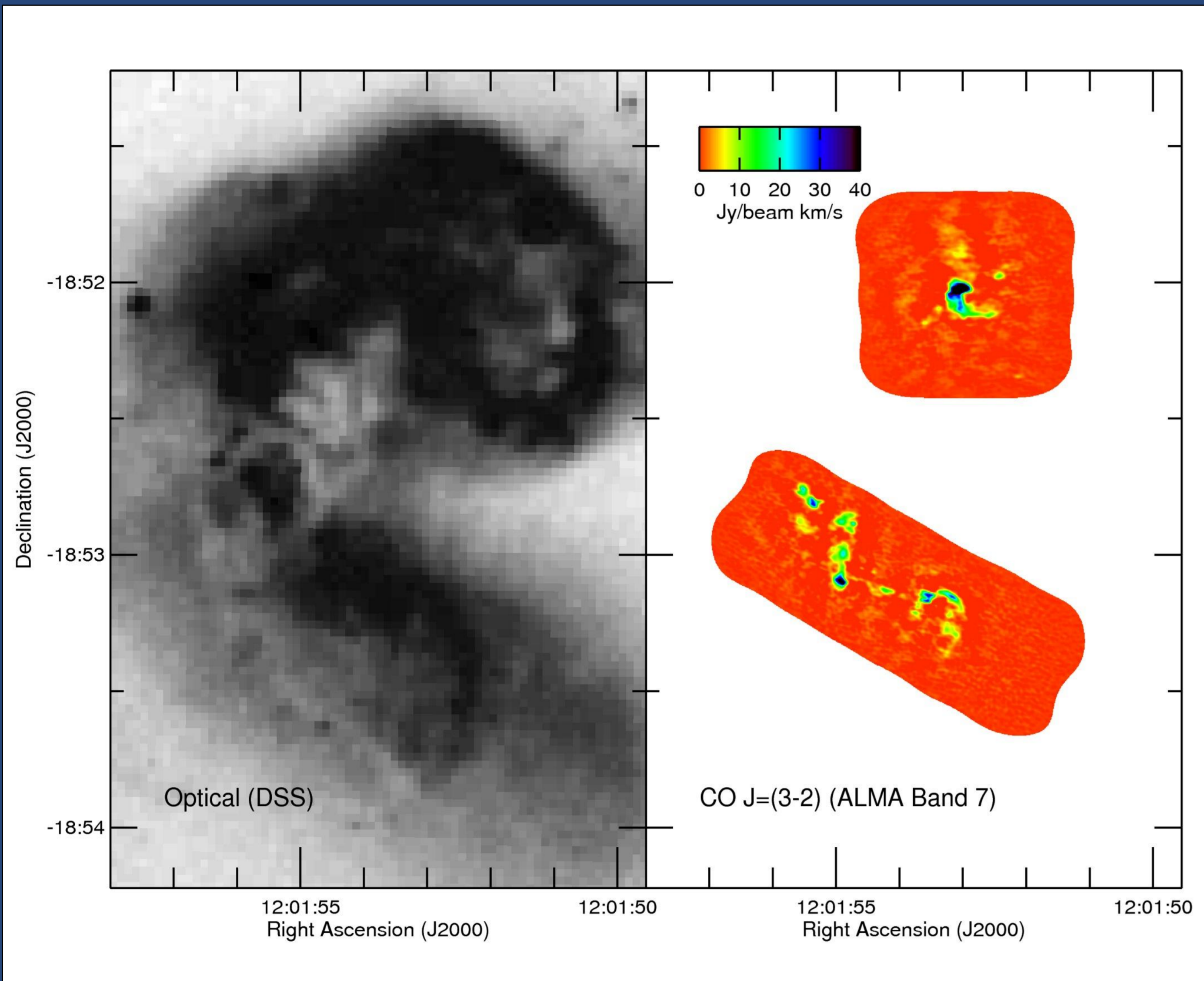


# Extragalactic Science with ALMA

UK ALMA Regional Centre Node (represented by George J. Bendo)

## Introduction

The Atacama Large Millimeter/submillimeter Array (ALMA) is a telescope comprising 66 antennae that is located in the Atacama Desert in Chile, one of the driest locations on Earth. When the telescope is fully operational, it will perform observations over ten receiver bands at wavelengths from 9.5-0.32 mm (31-950 GHz) with unprecedented sensitivities to continuum emission from cold (<20 K) dust, Bremsstrahlung, and synchrotron emission. With baselines out to 16km and dynamic reconfiguration, ALMA can achieve spatial resolutions ranging from 3 to 0.010 arcsec, allowing for detailed imaging of continuum or molecular line emission from 0.1-1 kpc scale gas and dust discs in high-redshift sources or 10-100 pc scale molecular clouds and substructures within nearby galaxies.



The above images show a 3'x2' optical (Digitized Sky Survey) image and Early Science CO J=(3-2) intensity map of the Antennae Galaxies (NGC 4038 / NGC 4039), an interacting pair of galaxies. The observations were performed using band 7 receivers set up to cover 1.875 GHz (1634 km/s) using 3840 channels, which gives a channel width of 488 kHz (0.426 km/s). The array was in a configuration that is intermediate between compact and extended; the resolution is ~1''. The northern region was mapped in 24 pointings, while the bottom region was mapped in 31 pointings. Both the data and a tutorial on the processing the data with CASA can be obtained from <http://almascience.eso.org/alma-data/science-verification/antennae>.

## Operations Timeline

30 Sep 2011	Cycle 0 (Early Science) observations begin
1-29 Feb 2012	Engineering shutdown
Mar/Apr 2012	Expected deadline for Cycle 1 proposals
30 Jun 2012	End of Cycle 0
2013	Construction completed

## Band Information

The table below provides information on the different bands that will be available for use at ALMA. Bands 1 and 2 are still under development, and incomplete information is available for Band 5. Bands marked with a star are bands that are available for Early Science observations.

Band	Frequency (Hz)	Wavelength (mm)	Primary Beam (")	Largest Scale (")	Compact Array Angular Resolution (")	Extended Array Angular Resolution (")
1	31-45	6.7-9.5				
2	67-90	3.3-4.5				
3*	84-116	2.6-3.6	56	37	3.18	0.038
4	125-163	1.8-2.4	48	32	2.5	0.03
5	163-211	1.4-1.8	35	23		
6*	211-275	1.1-1.4	27	18	1.52	0.018
7*	275-373	0.80-1.1	18	12	1.01	0.012
8	385-500	0.60-0.78	12	9	0.86	0.01
9*	602-720	0.42-0.50	9	6	0.52	0.006
10	787-950	0.32-0.38	7	5	0.38	0.005

## ALMA Organization

ALMA is a partnership between North America, Europe, and East Asia in cooperation with the Republic of Chile. Each region has its own ALMA Regional Centre (ARC). The organizations involved with ALMA are listed below. While Europe and East Asia have individual ARCs, Europe has several ARC Nodes that provide face-to-face support for astronomers.

- **Joint ALMA Observatory** (<http://www.almaobservatory.org/>)
- **European Southern Observatory**, Europe (<http://almascience.eso.org/>)
  - **Ondrejov Observatory**, Czech Republic (<http://www.asu.cas.cz/alma>)
  - **IRAM**, France (<http://www.iram.fr/IRAMFR/ARC/>)
  - **Argelander Institute for Astronomy**, Germany (<http://www.astro.uni-bonn.de/ARC/>)
  - **Istituto di Radioastronomia**, Italy (<http://www.alma.inaf.it/>)
  - **Leiden Observatory**, Netherlands (<http://www.alma-allegro.nl/>)
  - **Onsala Space Observatory**, Sweden (<http://www.chalmers.se/rss/oso-en/observations/alma-regional-centre>)
- **Jodrell Bank Centre for Astrophysics**, UK (<http://www.alma.ac.uk/>)
- **National Astronomy Radio Observatory**, North America (<https://science.nrao.edu/facilities/alma>)
- **National Astronomical Observatory of Japan**, East Asia (<http://almascience.nao.ac.jp/>)

## Support for ALMA Users

The ARCs provide the following services for the astronomical community:

- Support with proposal preparation and submission, including tutorials on using the ALMA Observing Tool (used to prepare and submit the proposal) and other tools.
- Evaluation of scheduling blocks (used to define the observations).
- Assistance with data reduction, including periodic workshops on using CASA (the data reduction software) and one-on-one user support at the ARCs.
- Software development, including CASA software.
- Outreach to the general public.

