Sunset Astronomical Society

The Sunset *Gazette*

Serving the Tri-Cities since 1975

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Meeting information

Meetings are generally in the theater in the Delta College Planetarium in Bay City. The meetings will usually be on the 2nd Friday of each month at 7:00 PM. Watch the newsletter for changes in dates and times. Membership is not required to participate in meetings and activities. See last Page for this month's meeting site.

Membership Information

Our club has switched to e-mailing our newsletters. For those wishing to receive a hard copy mailed an additional dues of $10.00 per year is required.

New Membership Rates:

5$ per Year

Treasurer's address for renewals and subscriptions:

Tom Smith, 3423 Hidden Road,

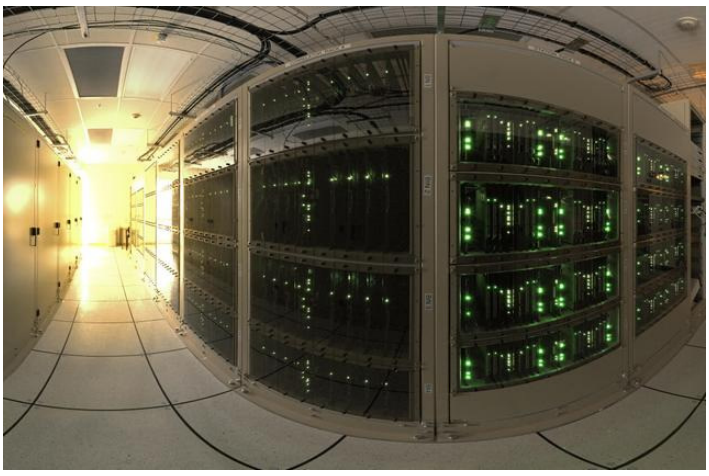
Bay City, MI 48706-1243

ALMA, the Atacama Large Milimeter/Submillimeter Array

The second part about ALMA, the first of the next generation of large and super-large telescopes, takes off with the transport of the antennas from the Operations Support Facility (OSF) at 2900 m above sea level to the 28 km distant Array Observations Site (AOS) at 5100 m altitude. Two special transporters have been build to accomplish this task. The 10 m wide and 20 m long vehicles have to transport each antenna without damaging it and then place them with millimeter accuracy on their concrete platforms. During the trip the engine output drops by about 50% due to the increasing height and decreasing amount of oxygen. Once placed on their platforms the antennas are connected to the electric power supply and the data transmission fiber optic cables. All the signals run to the AOS Technical Building where the ALMA correlator is placed. The correlator is in fact a super computer who combines all the signals so that ALMA can act like one single telescope. Maybe not fasted of all super computer but definitely one at the highest altitude.

"The first European antenna for the Atacama Large Millimeter/submillimeter Array (ALMA) reaches new heights, having been transported to the observatory's Array Operations Site (AOS)." Credit: ALMA (ESO/NAOJ/NRAO), S. Rossi (ESO)

Overall 192 antenna platforms have been built, much more than the actual number of antennas. This makes it possible to adapt the interferometer accordingly to the observational tasks. This way ALMA can change forth and back between a very compact antenna constellation with a

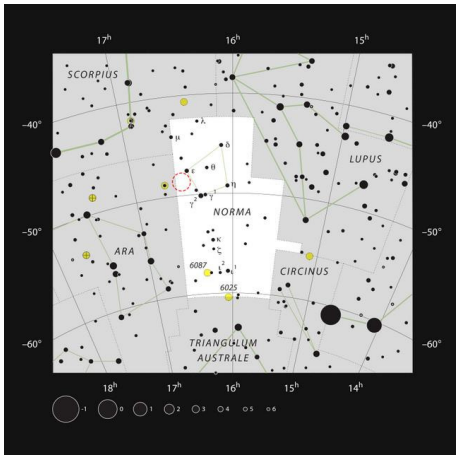


The ALMA correlator, one of the most powerful supercomputers in the world, has now been fully installed and tested at its remote, high altitude site in the Andes of northern Chile. This wide-angle view shows some of the racks of the correlator in the ALMA Array Operations Site Technical Building. This photograph shows one of four quadrants of the correlator. The full system has four identical quadrants, with over 134 million processors, performing up to 17 quadrillion operations per second. Credit: ESO

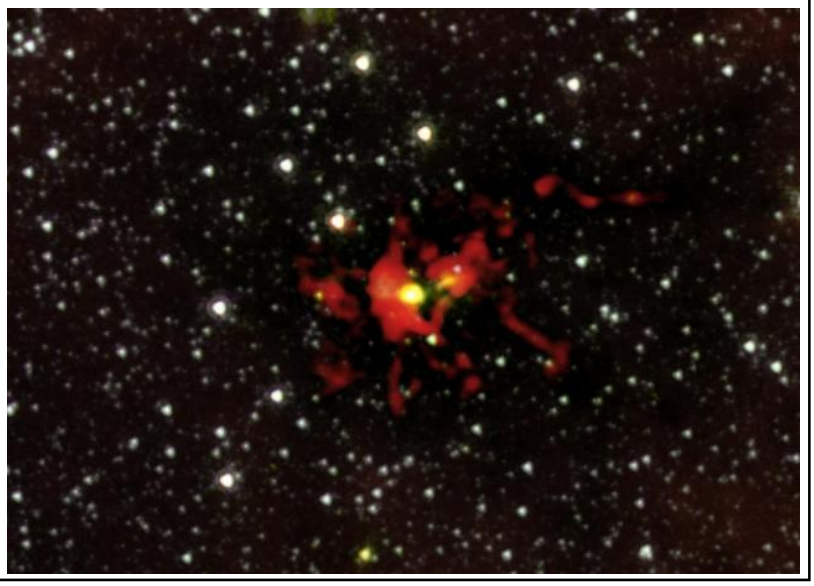
Of 150 m (ca 160 yards) to a configuration with a base line of 16 km (ca 10 miles). In this extended configuration ALMA manages to achieve a resolution of 0.005 arc seconds at the sub-millimeter wavelength. This is ten times better than the resolution of the Hubble Space telescope which has a maximum resolution of 0.05 arc seconds. You may now think that it would always be desirable to achieve the highest resolution and therefore work with the longest bas line. But with today's interferometers this would have the effect to filter out larger scales and this why there is also a ALMA Compact Array (ACA) consisting of the antennas build by the National Astronomical Observatory of Japan (NAO). The array is made up of four 12 m and twelve 7 m antenna and their smallest base line is only 12 m, exactly the diameter of one of the 12 m antenna, which enables the array to measure large scale structures. The combination of both arrays makes it possible to observe and dissolve objects which have small but also large scale structures. One disadvantage of ALMA is its small field of view: Compared with the Hubble Deep Field exposures ALMA would need hundreds of single exposures to cover the same area of 12 square arc minutes, not to mention ground based modern near infrared telescopes which can observe several square degrees with super wide field CCD cameras. At the end of this series I would like to present some quite impressive early science and research with ALMA:

The Atacama Compact Array (ACA) is a sub-system of the ALMA telescope which allows enhanced imaging fidelity especially for extended astronomical sources. The ACA comprises of 16 (four 12-m and twelve 7-m) antennas, the last of which was delivered by Japan in May, 2012. Credit: ALMA(ESO/NAOJ/NRAO), R. Hills

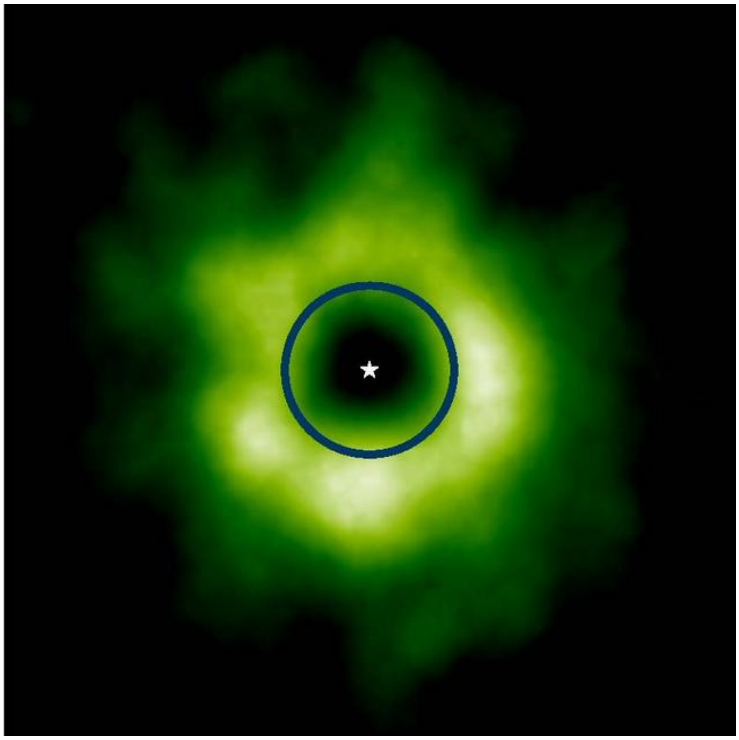
Science with ALMA: Since January 2013 ALMA has entered its second observational cycle with 32 of the 50 delivered antennas operational. The following pictures and texts



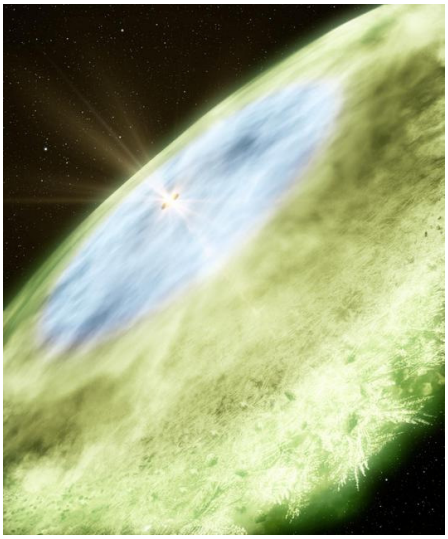
Left: This chart shows the southern constellation of Norma (The Carpenter's Square). Most of the stars that can be seen in a dark sky with the unaided eye are marked. The location of the dark star-forming cloud SDC 335.579-0.292 is indicated with a red circle. Although the dark cloud cannot be seen visually there are many other brighter objects in this part of the sky, including the star cluster NGC 6134. Credit: ESO, IAU and Sky & Telescope



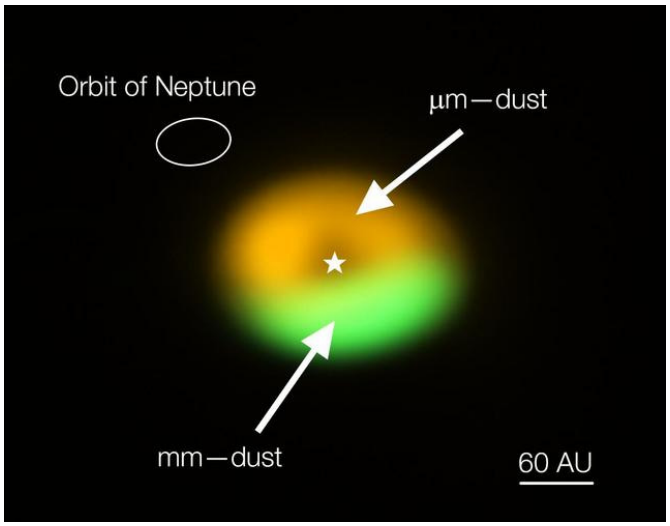
Right: Observations of the dark cloud SDC 335.579-0.292 using ALMA, have given astronomers the best view yet of a monster star in the process of forming. A stellar womb with over 500 times the mass than the Sun has been found and appears as the yellow blob near the center of this picture. This is the largest ever seen in the Milky Way - and it is still growing. The embryonic star within is hungrily feeding on the material that is racing inwards. It is expected to give birth to a very brilliant star with up to 100 times the mass of the Sun. This image combines data from ALMA and NASA's Spitzer Space Telescope. Credit: ALMA (ESO/NRAJ/NRAO)/NASA/Spitzer/JPL-Caltech/GLIMPSE



CO snow formed around the star TW Hydrae
ALMA image (green) shows the region where CO snow has formed around the star TW Hydrae (indicated at center). The blue circle represents where the orbit of Neptune would be when comparing it to the size of our solar system. Credit: Karin Oberg, Harvard University/University of Virginia



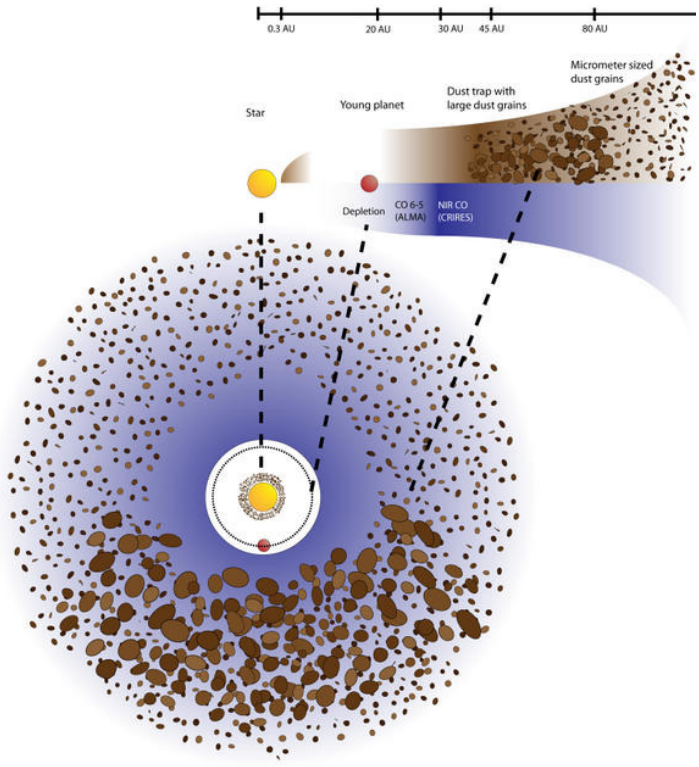
Artist concept of snow line in TW Hydrae showing water covered ice grains in the inner disk (4.5 -- 30 AU, blue) and CO ice covered grains in the outer disk (>30 AU, green). The transition from blue to green marks the CO snow line. Credit: B. Saxton & A. Angelich/NRAO/AUI/NSF/ALMA (ESO/NAOJ/NRAO)



ALMA image of dust trap/comet factory around Oph-IRS 48 (annotated)

Annotated image from the Atacama Large Millimeter/submillimeter Array (ALMA) showing the dust trap in the disc that surrounds the system Oph-IRS 48. The dust trap provides a safe haven for the tiny dust particles in the disc, allowing them to clump together and grow to sizes that allow them to survive on their own. The green area is the dust trap, where the bigger particles accumulate. The size of the orbit of Neptune is shown in the upper left corner to show the scale. Credit: ALMA (ESO/NAOJ/NRAO), Nienke van der Marel

are taken directly from these observations and can be found under **http://www.almaobservatory.org/.**



Artist's impression of the proposed disk structure of Oph IRS 48

The brown spots represent the large and small grains. The larger grains detected by ALMA are concentrated in the dust trap at the bottom of the image. The blue represents the distribution of carbon monoxide gas. The gap in the disk is shown with the proposed planetary body that is sweeping the area clear and providing the conditions necessary to form the dust trap. Credit: ALMA(ESO/NAOJ/NRAO), Nienke van der Marel

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This issue can be accessed in color on the website of the SAS!!!
http://www.sunsetastronomicalsociety.com

SAS Meeting

Start: 7:00 PM

Friday, Sep 13th, 2013

Delta Planetarium

Welcome members and guests

New and old business

Club Business

Treasure report

Refreshments Break

Presentation:

TBD

If clear we will observe on the observation deck.

What's up in the Sky

Sep 3-17 *Dawn*: Look out for the zodiacal light in the east 120 to 80 min before sunrise. Dark location needed. The zodiacal light looks like a tall, broad pyramid of light with Jupiter near its apex.

Sep 5,6 *Dusk*: Watch out for Spica less than 2 deg below much brighter Venus in the west-southwest.

Sep 5: New Moon

Sep 8,9 *Pre-Dawn*: Mars passes through M44 the bee-hive cluster.

Sep 8 *Dusk*: Venus extremely close to the thin crescent Moon with Saturn to the upper left and Spica nearby.

Sep 9 *Dusk*: Saturn can be seen to the right of the Moon and Venus to their lower right.

Sep 12: First Quarter Moon

Sep 16-19 *Dusk*: Saturn can be found less than 4 deg from Venus.

Sep 19: Full Moon

Sep 22: Autumn begins in the Northern Hemisphere

Sep 24 *Dusk*: Use binoculars or telescopes for Spic just 3/4 deg below brighter Mercury very low in the west-southwest 15 to 30 min after sunset.

Sep 26: Last Quarter Moon

Sep 28 *Dawn*: Look out for Jupiter which shines to the upper left of the waning crescent Moon.

UPCOMING EVENTS

September 5th - 8th, 2013

2013 Eleventh Annual Great Lakes Star Gaze Star Party at the River Valley RV Park in Gladwin, MI. Registration is now open.

http://www.greatlakesstargaze.com