Activity Report of Commission J

November 2013 to March 2014

March 26, 2014

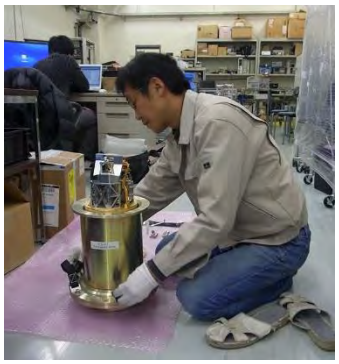
Kenta Fujisawa (Yamaguchi University)

ALMA project

- *Mar 03, 2014 All NAOJ ALMA Receivers Shipped Out*

On February 18, the NAOJ Advanced Technology Center shipped out the last seven ALMA Band 10 receivers to Chile. This marks the completion of delivery of a total 219 receivers for three frequency bands developed by NAOJ.

The development and production were complete in December 2013 (See "Completion of the ALMA Receiver Development" on Dec 27, 2013 on Latest News) After this, the receivers had preliminary in-house acceptance tests, packing, attachment of shock logger to record the shock given to the product during transport, and applicable export procedures. On the day of the last shipping, members of the Band 10 development team saw off the receivers contained in a shipping case and loaded on a truck, saying goodbye to them.

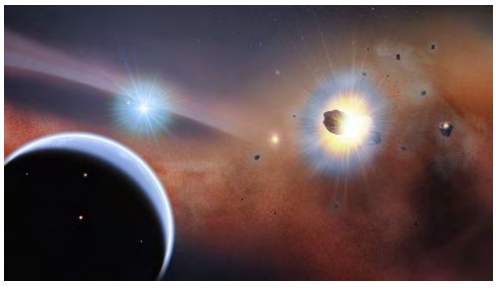


The picture shows Yasunori Fujii, a research engineer and a member of the Band 10 development team, during packing of a receiver in a metal transport container.

- Latest scientific topics:

1. *Mar 10, 2014 Crashing Comets Explain Surprise Gas Around Young Star? ALMA reveals an enigmatic gas clump in debris disk around Beta Pictoris*

Astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) telescope in northern Chile have today announced the discovery of an unexpected clump of carbon monoxide gas in the dusty disk around the star Beta Pictoris. This is a surprise, as such gas is expected to be rapidly destroyed by starlight. Something - probably frequent collisions between small, icy objects such as comets - must be causing the gas to be continuously replenished. The new results are published today in the journal Science.



Credit: NASA's Goddard Space Flight Center/F. Reddy

2. *Jan 17, 2014 ALMA Discovers a Formation Site of a Giant Planetary System*

A team of Japanese astronomers has obtained a firm evidence of formation of a giant planetary system around a young star by the observations with the Atacama Large

Millimeter/submillimeter Array (ALMA). This result has a transformative impact on the theories of planet formation and gives us a clue to the origin of a wide variety of planetary systems.

The research team, led by astronomers at Osaka University and Ibaraki University, observed a young star named HD142527 in the constellation Lupus (the Wolf) with ALMA. The ALMA image shows that cosmic dust, which is component material of planets, is circling around the star in a form of asymmetric ring. By measuring the density of dust in the densest part of the ring, the astronomers found that it is highly possible that planets are now being formed in that region. This region is far from the central star, about 5 times larger than the distance between the Sun and the Neptune. This is the first firm evidence of planet formation found so far from the central star in a protoplanetary disk. The research team plans further observations of HD142527 with ALMA for closer investigation, as well as other protoplanetary disks to have a comprehensive understanding of the planet formation in general.

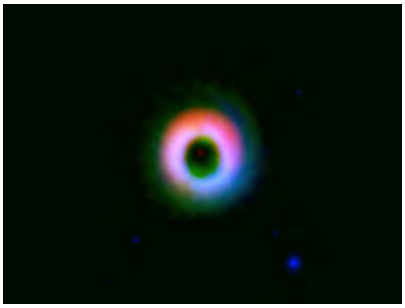


Figure. Dust and gas disk around HD142527. The dust and gas distributions observed by ALMA are shown in red and green, respectively. Near-infrared image taken by the NAOJ Subaru Telescope is shown in blue. The image clearly shows that the dust is concentrated in the northern (upper) part of the disk.
Credit: ALMA (ESO/NAOJ/NRAO), NAOJ, Fukagawa et al.

Activities of meetings

- **Symposium of Radio Astronomy Forum 2013**

  Date: 18 – 19 December 20013

  Place: National Astronomical Observatory of Japan, Mitaka

  Overview: The Square Kilometre Array (SKA) project is an international effort to build the world's largest radio telescope, with a square kilometre (one million square metres) of collecting area. The scale of the SKA represents a huge leap forward in both engineering and research & development towards building and delivering a unique instrument, with the detailed design and preparation now well under way. As one of the largest scientific endeavours in history, the SKA will bring together a wealth of the world's finest scientists, engineers and policy makers to bring the project to fruition. In Japan, a SKA consortium is formed and preparation research and basic development by a volunteer are furthered since 2008. SKA was proposed as a master plan of Science Council of Japan in 2013, and discussions of future contribution has been started.

  At this symposium, the update status of SKA, a scientific result to aim at, and the activity in Japan were reported and discussed. The target of this symposium were the common

understanding on the result which SKA would bring about to the local radio astronomy community and its scientific importance. Also how SKA is treated as large-sized future planning of Japanese radio astronomy was discussed.

- **VLBI Consortium Symposium 2013**

  Date: 24-26 December 2013

  Place: Tsukuba University, General Research Building B, room 110

  URL: http://aobs.frsc.tsukuba.ac.jp/~nagai/vlbi_symp/

- **ALMA Workshop on Long Baseline and Phase Correction**

  Date: 25-26 December 2013

  Place: National Astronomical Observatory of Japan, Mitaka

  Overview: The proposal for ALMA Cycle 2 was closed, and the results of Cycle 0 have been also published one after another. The efforts for upgrading the performance of ALMA has been also continued. There is a strong requirement of "realization of a long baseline" that exceeds 10 km is now as one of the most important development items. In order to realize a long baseline and high spatial resolution (0.01 arcsecond which is the final target of ALMA), an understanding of the influence of atmospheric effect on the millimeter and submillimeter wave observation, including realization of a phase compensation is indispensable. Hence we held "ALMA Workshop on Long Baseline and Phase Correction" in National Astronomical Observatory Mitaka for discussing these topics.

- **Workshop on the Radio Astronomical Application of JAXA Telecommunication Antenna**

  Date: 7 January, 2014

  Venue: ISAS/JAXA Conference room A 2F

  Aims and Scope: JAXA is employing antennas including Usuda 64 m for deep space communication. These antenna also can be used for the radio observation of planetary science and radio astronomy. So far, the signal transmission system for VLBI and the record system are mainly used for these observations. Here we held a workshop for discussing about the current situation of these equipment, and future capacity utilization and common use.

- **Millimeter and submillimeter radio wave receiver workshop**

  Date: 3-4 March 2014

  Place: Ibaraki University, Interview Studio

  Overview: The target of this workshop is development of component and engineerings, such as: receiver development, detection element and an element manufacture process, optical system and antenna, oscillator, HEMT amplifier, cooling technology, integration, and the intensity calibration technique. It would be a topic that the result of application of such technology. It is

also the purposes to communicate the space observation project in universities and research institutions and to offer the place of information exchange about next-generation equipment strategy and subject.

Recently astronomical research project are tend to be internationalized and large-sized, like ALMA, satellite, large ground telescope, etc. Also the international competition is increasing further. This workshop is only the domestic workshop in this field. Every year, not only a researcher but also graduate students and corporate-relations persons gathered, and discussed on the technology of the millimeter wave to terahertz wave. Hence we would like to hold this year also, we are pleased if you can participate in this workshop.

- **General Meeting of Radio Astronomy Forum**

  Date: 21 March 2014

  Place: International Christian University