Atacama Large Millimeter/submillimeter Array

Submillimeter instrumentation
- EA ALMA & ASTE & Others -

Satoru Iguchi, NAOJ

JCMT Instrumentation Meeting on 8 March, 2016

ALMA Upgrade Plan

Major Science Themes in the 2020-2030 Decade

Executive Summary

ALMA was designed to address many science questions in the broad area sometimes bundled under the umbrella question: "How does the Universe work?" This includes areas in which the submillimetre band has traditionally advanced knowledge, such as the physics and chemistry of the ISM, the formation of stars and disks, the structure and evolution of galaxies and AGN. ALMA also has the potential to contribute to the highest profile areas of astrophysics, namely the search for life elsewhere, and placing constraints on fundamental physics.

ASAC

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Technical Key words

1. Data Archive
2. Multi-beam
3. Wideband
4. High resolution

Planning
Future ALMA Development Programs

2011
EA ALMA
Development WS

Output: three EA led projects/studies

- Band 1 ✓ prototype
- Band 11 ✓ initial study
- Artificial Calibration Source ✓ commissioning

2013
EA ALMA
Development WS

Output: New science demands for ALMA

- Angular Res.
- Fidelity
- FOV
- Sensitivity
- Wide IF

2014
EA ASTE/ALMA
Development WS

- Multi-beam
- THz
- TES Cam
- Wideband Spectrometer

Next gen dev for ASTE, with future vision for ALMA development.
Output: Science requirements, ASTE/ALMA dev timeline.

2015

Antenna Development WS in 2015

EA ALMA High Priority Projects

- Full Projects
  - Band 1 project
    - Lead: ASIAA
    - Collaboration: NAOJ, U of Chile, NRAO, HIA)
    - Baseline capability (35-50GHz)
  - Band 2 (NA), Combining Band 2 and 3 (EU)
    - EA contribution: Optics design
  - Band 5
    - EA contribution: Front end integration at the OSF

EA ALMA High Priority Projects

- Small Projects
  - ALMA Calibration Source
    - Calibration at bands 3,6,7
    - Lead: Kiuchi-san in NAOJ
    - Collaboration: Richard Hills
  - Spectrometer
    - Lead: KASI
    - Collaboration: NAOJ
    - GPU Spectrometer for TP array
    - Supplements the ACA correlator

EA ALMA High Priority Projects

- Studies
  - High Critical Current Density (Jc) SIS Junction Device Development (including THz devices)

ASTE

- Multi-beam receiver
  - KASI with NAOJ (already Jung-Won Lee)
- Ultra-wideband – Band 7to8
  - KASI with NAOJ (already Jung-Wong Lee)
- TES Camera
  - NAOJ
- DESIMA with MKIDs
  - SRON, Delft University
- Polarimeter

Timeline

	2016	2017	2018	2019
Band 1 (w/ ASIAA)	• CDR/Proj Review • MRR			• AIV
Calibration Source	• 100GHz source testing		• 200-300 GHz source delivery	
TP Spectrometer (w/ KASI)	• Seek board approval • PDR	• CDR	• AIV	
High Critical Current Density SIS Junction Device	• research	• research		
Multi-beam for ASTE (w/ KASI)	• PDR/CDR	• Installation		

Others

- LiteBIRD
  - Lite (Light) Satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection
  - http://litebird.jp/eng/

- LST
  - Large Submillimeter Telescope
    - Compact Array vs Large Single Dish