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The Atacama Large Millimeter Array (ALMA): Implications of a Potential Descope—*Summary*

BOARD ON PHYSICS AND ASTRONOMY

Background

The 1991 NRC decadal survey for astronomy and astrophysics included the Millimeter Array (MMA), an array of millimeter-wavelength telescopes intended to capture images of star-forming regions and distant star-burst galaxies. With the addition of commitments from Europe and Japan, the MMA evolved into the Atacama Large Millimeter Array (ALMA), a proposed array of 64, 12-meter antennas. The project is now part of the NSF Major Research Equipment and Facilities budget request. Increased cost projections, however, have forced the NSF to reconsider the number of antennas. To help with that review, NSF asked the NRC to assess the scientific consequences of reducing the number of active antennas from 60 to either 50 or 40.

Findings

A 60-element array would be greatly superior to any current or planned comparable instrument for several decades and would revolutionize millimeter and submillimeter astronomy.

Two of the three level-1 requirements, involving sensitivity and high-contrast imaging of protostellar disks, will not be met with either a 40- or a 50-antenna array. It is not clear if the third requirement, on dynamic range, can be met with a 40-antenna array even if extremely long integrations are allowed for.

Speed, image fidelity, mosaicing ability, and point source sensitivity will all be affected if the ALMA array is descoped. The severest degradation is in image fidelity, which will be reduced by factors of two and three with descopes to 50 and 40 antennas, respectively.

Despite not achieving the level-1 requirements, a descoped array with 50 or 40 antennas would still be capable of producing transformational results, particularly in advancing understanding of the youngest galaxies in the universe, how the majority of galaxies evolved, and the structure of protoplanetary disks, and would warrant continued support by the United States.

Furthermore, it is the committee's appraisal that a 40-antenna array would retain ALMA's strong support within the general astronomical community. However, the rapid decline in imaging capability that would result with a further reduction below 40 antennas would erode this support.

For further information

Copies of the complete report*, The Atacama Large Millimeter Array (ALMA): Implications of a Potential Descope,* can be obtained on the National Academy Press Web site <www.nap.edu/catalog/ >**.**

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COMMITTEE TO REVIEW THE SCIENCE REQUIREMENTS FOR THE ATACAMA LARGE MILLIMETER ARRAY

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Staff

DONALD C. SHAPERO, Director, Board on Physics and Astronomy; **BRIAN D. DEWHURST**, Study Director; **CELESTE A. NAYLOR**, Senior Project Assistant