

Calibration and Standardization of Large Surveys and Missions in Astronomy and Astrophysics



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Amplitude Calibration at Millimeter and Submillimeter Wavelengths

The goal of amplitude and flux calibration at millimeter and submillimeter wavelengths is to convert the output voltage or counts from a telescope spectrometer into brightness temperature or flux density. Because the adverse effects of instrumental and atmospheric variations of the detected amplitude grow rapidly with frequency, standard calibration procedures used at longer radio wavelengths are generally not directly applicable at millimeter and submillimeter wavelengths. Furthermore, the design specifications of the Atacama Large Millimeter Array (ALMA) require a much higher calibration accuracy than that achieved by conventional techniques. The ALMA amplitude calibration requirements are: relative amplitude calibration of 1%/3% for frequencies less than/greater than or equal to 370 GHz, absolute amplitude calibration of 5% at all frequencies. These amplitude calibration requirements are much more stringent than those obtained at existing millimeter and submillimeter observatories, which are typically no better than 10%. ALMA's scientific capabilities, including the production of high dynamic range (>1000) images, for example, require better than a few percent accuracy in amplitude calibration, and there are many scientific demands for achieving similarly high accuracy in flux calibration as well. In this presentation we will discuss the amplitude calibration system used for ALMA and its plans for attaining the high standard of amplitude calibration accuracy called for by its specifications. In particular we will review the flux calibration sources which have been considered for ALMA and discuss their strengths and weaknesses. We will present some recent studies of K-M giant stars which are a promising class of flux calibration source for ALMA.

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