Using 3c147 as a calibrator, we obtained broadband, high-resolution spectra of 3c48, 3c138, and M82, spanning frequencies from 0.5 to 7 GHz.

Motivations

• Use the ATA to obtain continuous spectra and assess their quality with comparisons to well-known sources. Future work will obtain continuous spectra of Jupiter and other planets. Broadband spectra could also be used to probe the electron cooling times of starburst regions.
• Measure ATA antenna gains across a large range of frequency.
• Characterize the RFI environment at Hat Creek in detail to aid in the planning of future observations and surveys.

Conclusions

• The ATA can be used to obtain broadband spectra of sources even in high-RFI bands. The upper frequency limit of these observations is a function of the current state of the ATA focusing mechanism. Impending technical improvements will enable observations up to 11.2 GHz.
• Based on fits to a priori models, the fluxes we obtain are accurate to ~13%.
• Repeated measurements of a given source at a given frequency are consistent with one another to ~9%.

Repeatability

The targets were observed at frequencies from 0.5 to 1.7 GHz on four separate nights. At right, the spectra obtained from each individual night's observing are grouped by source and plotted. Even in this RFI-heavy region of the spectrum, repeatability is good with systematic variations and uncertainties of comparable size. The full spectra to the left combine the data from all four nights to generate results of higher precision than could be obtained individually.

Images

The image to the far left is of the reference source, 3c147, at 980 MHz, a band with a moderate amount of RFI. The nearer image shows 3c138 at the same frequency. Because 3c138 is a fainter source and the antenna gains and data flags are optimized for the 3c147 data, the left image is perceptibly cleaner than the right, though the quality of the 3c138 image is more than sufficient to determine fluxes to good precision. Higher-SNR images can be obtained from longer integration times (both images here were generated from two minutes of integration) or via multifrequency synthesis of data in several spectral windows.

RFI at Hat Creek

This plot characterizes the RFI environment at Hat Creek. It shows the summed signal amplitude for each spectral channel in the entire 6.5 GHz frequency range our observations covered. Even though there is a large amount of interference at 1 GHz and below, the high resolution of the ATA correlator makes it possible to obtain good results even in this noisy environment.

Analysis Procedure

Observing. The reference source (3c147) and science targets (3c48, 3c138, and M82) are observed in a sequence of one minute integrations at various frequencies. An observing run typically covers a range of ~1.5 GHz with individual observations spaced by 80 MHz.

Phase closure flagging. The data are examined for phase closure errors. Those baselines frequently associated with bad phases closures are flagged.

Self-cal flagging. After the baselines associated with bad phases closures are flagged out, a subsample 3c147 data are interactively flagged until they yield acceptable self-calibration results. The consistently bad baselines are flagged out in all of the right data.

Empirical correction. Because the self-calibrated antenna gains are optimized from a self-calibration of the 3c147 data assuming the Baars et al. model. The gains are transferred to the rest of the data and used to calculate maps, from which fluxes are determined with point-source models.

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