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Observational Test of the ACA Phase Correction Scheme with the SMA

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Interferometers at millimeter and submillimeter wavelengths are highly affected by the refraction induced by water vapor in the troposphere, which results as phase fluctuations. The Atacama Compact Array (ACA) is planning to compensate the atmospheric phase fluctuations using the phase information of the outermost antennas with interpolating to the inner antennas by creating a phase screen. Asaki et al. (2005) conducted a series of simulations of the phase correction scheme for the ACA, and succeeded to compensate the atmospheric phase well. This strongly supports the use of the proposed phase correction scheme.

We conducted the observational tests of a phase correction scheme for the ACA using the Submillimeter Array (SMA). We observed a strong quasar B1921 – 293 (J1924 – 291) around 230 GHz for about an hour with the integration time for one data point of 5.16 seconds. The quasar was strong enough to detect within one integration. Using the phase information of this quasar, we produce a plane of a wavefront (phase screen) from the phase information of three antennas (reference antenna triangle) for each integration, and this phase screen is used for the interpolation and extrapolation of the phases of inner and outer antennas from the reference antenna triangle, respectively. The interpolation scheme apparently reduced the phase fluctuations from the original fluctuations. Our astronomical observation results together with the simulation results mentioned above strongly support that the ACA phase correction scheme will work well. On the other hand, the extrapolation scheme often does not improve the results.