Akatsuki's IR2 Nightside Photometry Restoration by Deconvolution

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Akatsuki’s IR2 camera captures images of Venus at different filters: 1.735um, 2.26um, and 2.32um. At near-dawn/dusk views (phase angles ~90 to 115 degree) of these images, the nightside photometry is contaminated by the intense dayside reflectance. As the potential well of a pixel is overfilled with incoming generated photoelectrons, the pixel is saturated and hence no longer contain information. This saturation can occur in the dayside and nightside near the terminator.
Owing to the saturation problem, main task of the restoration process is thus to simulate both day and night sides to replace the information loss in saturation. Point spread function (PSF) of the IR2 camera was modeled using Moffat function with observation of experimental image taken of point source street light before launch. Then, deconvolution by model-PSF can restore the nightside photometry of unsaturated pixels. Dayside reflectance was modeled with Lambert’s law, where its distribution is multiplied by an F factor (W m^{-2} sr^{-1} um^{-1}). Methods of finding the F factor will be shown.
We present our Restoration by Deconvolution (RD) results of the selected dates. The restored images were limb darkening corrected. Efficiency of RD can be restored to ~0.005 sigma in standard deviation accuracy when performed on synthetic image with known answer image.
Correlation plot of unsaturated nightside radiances between two filters (2.26mm and 1.735mm) were produced to extract possible ‘branch’ phenomena. The branching in the correlation plot indicates the differences in optical depths of different particle size modes [1].
Restoration of nightside pixels also opens up the opportunity to study the cloud dynamics transiting from the dayside into the nightside. Moreover, interesting cloud features such as vortices, instabilities, and streaks are more distinct in recovered images. This in overall opens up new window to understanding the evolution of cloud motion in the middle layer.
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Keywords: Venus, atmosphere, image restoration, infrared