Astronomy 423 Homework Set 7

Due: Monday, Apr 3

1. Use self-calibration on the VLBA observations J1938+0448 at 8 GHz to obtain a better continuum image. You will need this before you can do the phase-referencing for J1927.5, plus its always good to image your calibrator and learn about what the data quality looks like on a strong source. Hint – start with the file J1938+0448.TBX0 (created by me with SPLIT after calibrating the multi-source run), load that into AIPS with FITLD, and run IMAGR to make an image, then CALIB to use that image and make a new (u,v) data set which you should call J1938+0448.TBX1. Start with phase self-cal only (solmode='p') and only after the image isn't getting any better should you switch to amplitude and phase selfcal (solmode='a&p'). Since the data is sparse you will want to provide IMAGR with support (boxes). You should use the tutorial handout (AIPStutorial.pdf) which contains some excerpts from the AIPS cookbook. If needed you can also consult the AIPS cookbook (http://www.aips.nrao.edu/cook.html). As you go along answer the following questions for J1938+0448 at 8 GHz:

    a) What is the expected thermal noise? (by hand or with EVN calculator)
    b) Measure the noise (measured off source using task IMEAN) of your initial image. Can you reach the thermal noise, and if not, why not?
    c) With so few antennas, it helps a lot to provide support. Do this by defining clean boxes in IMAGR. You can define them using TVBOX with nbox=2 or 3 or however many you need to describe the source. What are the dimensions of your first box?
    d) Show the progression of the peak flux, total cleaned flux (based on the total flux in all clean components), rms noise, and dynamic range (peak/noise) in the image. You should do at least 2 phase-only and 2 a&p iterations.
    e) Can you find any bad data? Describe the time(s) and antenna(s) affected.
    f) Use JMFIT to fit a Gaussian to the core. Report the flux, size, and position for the source(s). Compare the derived position to the observed position.
    g) Did you find any structure? Which direction does it go?
    h) Provide two different estimates of the flux density of J1938+0448: (1) from the modelfit from JMFIT; and (2) using a box in the image plane using IMEAN.
    i) Compare your results above to a visibility plot of amplitude vs (u,v) distance for the fully calibrated data.
    j) Make contour plots of your best Stokes I image and turn in a hardcopy. Best image gets +5 points. Better image than mine gets +10 points.