# MWAL Module 5 : radio-VLA, A.Y. 2025/2026

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## Optional activity to overlay radio contours on an X-ray image

**DS9 : Software to visualize and analyze FITS files** (typically X-ray data), already installed on lab M computers. If you work on your laptop, download and follow installation instructions at the link: https://sites.google.com/cfa.harvard.edu/saoimageds9/home

**Mini-tutorial of ds9:**

### 1. Create a file with the radio contours

- **File → Open** : select the radio map**.fits** to load the radio image you produced with tclean (*choose the "natural" weighting one*), converted into a fits format in CASA with the command : exportfits(imagename='map.image',fitsimage='map.fits')
- **Scale → Log**
- **Color → ..** (for example, b)
- **Edit → Pan** : click on the point to be centered
- **Zoom → zoom in/out**
- **Edit → Colorbar** : click and move in circle to change the color scale
- **Analysis → Contour Parameters** : type the values corresponding to the radio contours levels you want to draw (typically starting at 3 sigma rms) in the right box of the pop-up window, then hit the button "Apply"
- **Analysis → Contour Parameters → File → Save** : choose a name for the file where you want to save the radio contours, e.g. "radio-contours.ctr"

## 2. Load the *Chandra* X-ray image and overlay the radio contours

- **File → Open** : select file **rbs797-chandra_gitti.fits**
- **Scale → Log**
- **Color → ..** (ex. b)
- **Edit → Pan** : click on the point to be centered
- **Zoom → zoom in/out**
- **Edit → Colorbar** : click and move in circle to change the color scale
- **Analysis → Contour Parameters → File → Open** : select the file.ctr of the radio contours you produced in step 1., e.g. “radio-contours.ctr”
- **Edit → Region** : to edit regions
- **Region → Shape → Line/Circle/Ellipse/Ruler..** : create a region with a certain shape ; double click on the selected region to open the menu info that shows also the angular dimensions. In a corner of the image, add a line corresponding to a physical length of e.g., 50 kpc (with a text label indicating the actual value): this is useful to immediately understand the physical size of the image