

Spectral Line Image Analysis and Visualization



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Interesting spectral lines, e.g.

- **HI** (21-cm, 1420.405 MHz) !!!
= neutral atomic hydrogen
- **HCN** (3mm, 89632 MHz)
= molecular hydrogen cyanid
- **SiO** (3mm, 86243 MHz)
= maser line
- ... many, many, many more

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Let's concentrate on HI :

- There is lots of neutral hydrogen gas in galaxies -> **HI is easy** to detect
- HI traces the **large-scale structure and kinematics** of galaxies
- **HI rotation curve** -> gas and total mass
- HI also traces HVCs and tidal gas clouds -> study **galaxy collisions**
- HI emission and absorption studies

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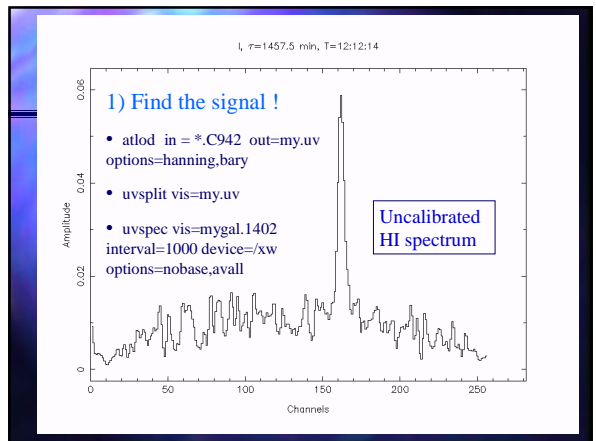
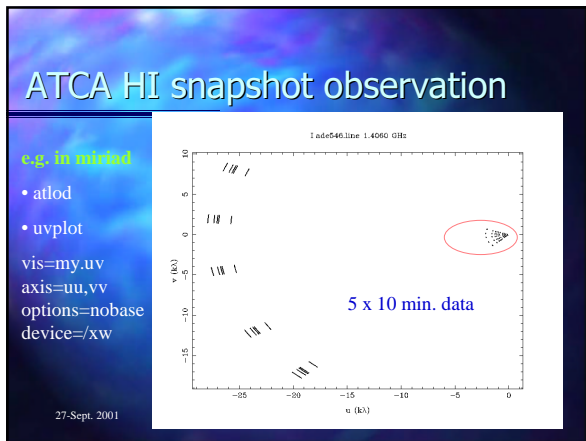
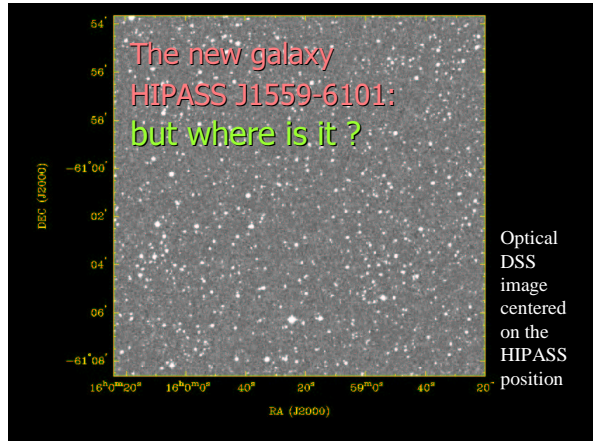
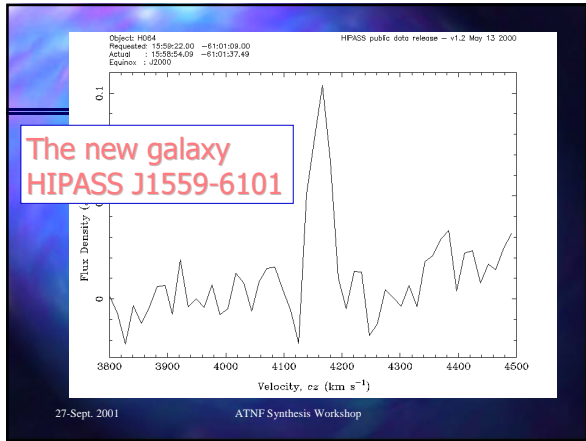
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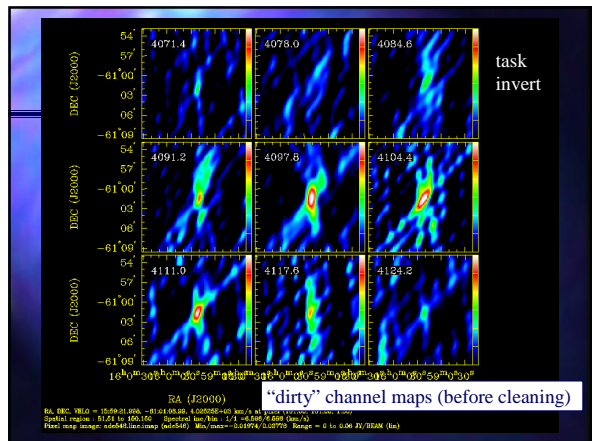
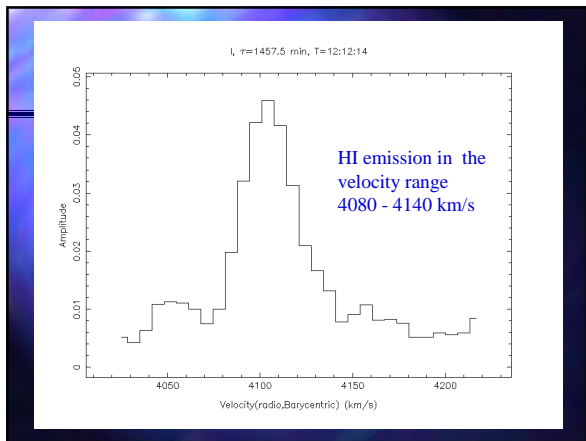
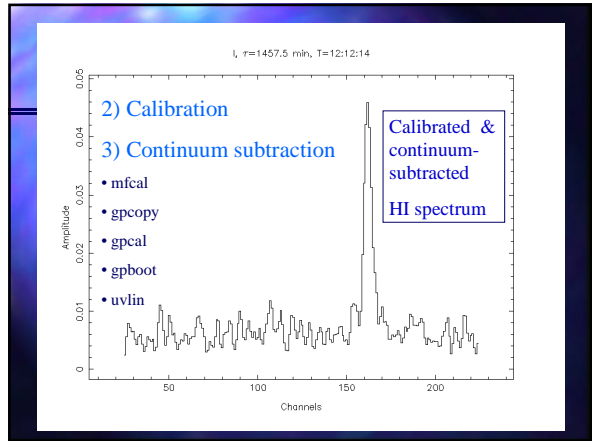
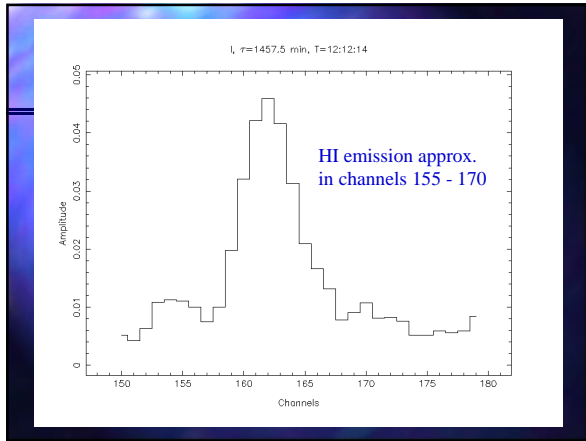
1. Experiment (quick and dirty)

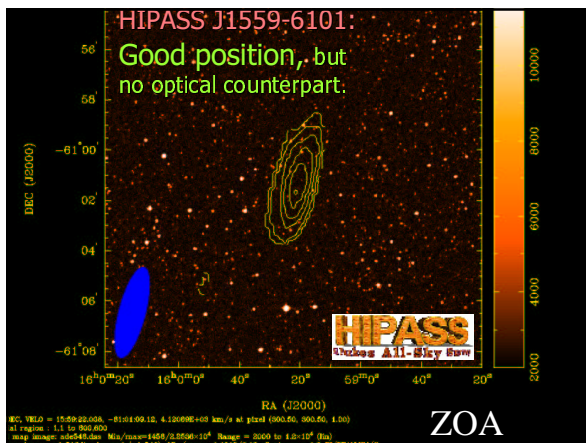
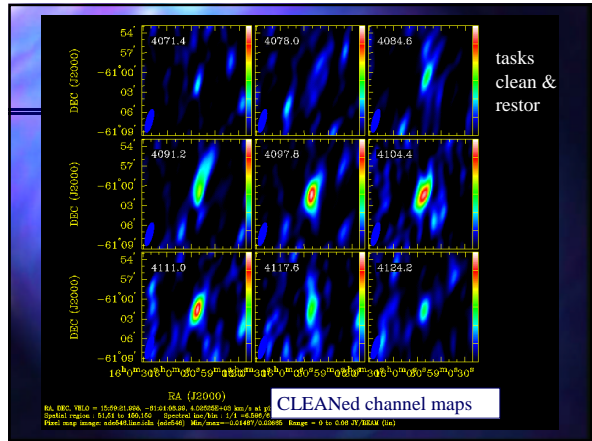
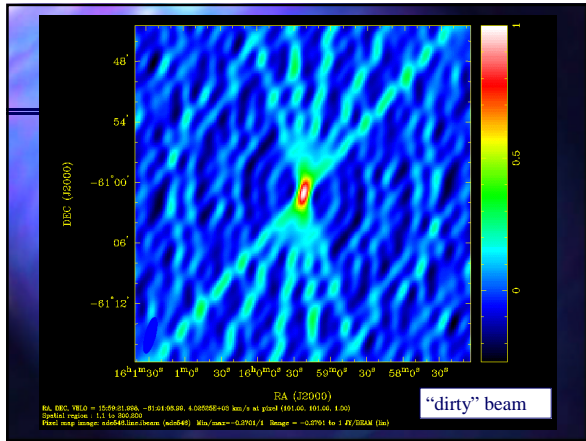
- **HI snapshot observations**
 - e.g., observe 5 galaxies for 10 min. each plus nearby phase calibrator(s)
 - repeat 12 times to obtain 12-hour uv-coverage
 - make images
 - get galaxy positions

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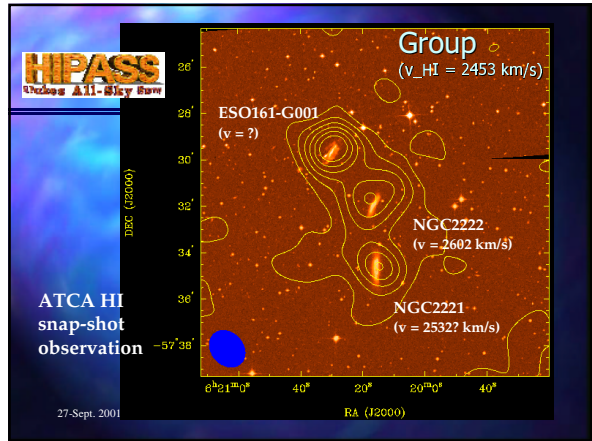
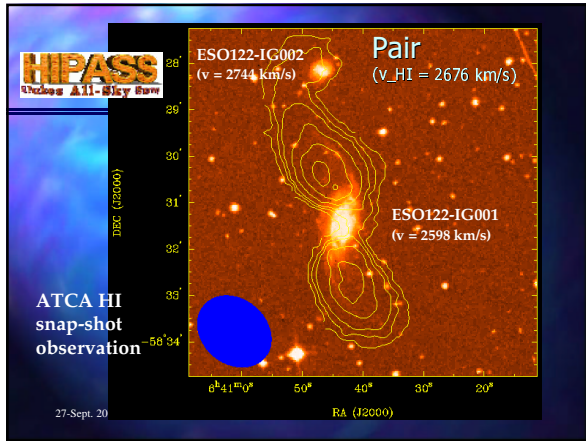


Moment maps ... are very useful

- = intelligent cube compression
- 0. *mom* = integrated HI intensity
- 1. *mom* = mean HI velocity field
- 2. *mom* = mean HI velocity dispersion
- > see Chapter 12.11

task *momnt* or *xmom* in AIPS;
 task *moment* in MIRIAD; etc.

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2. Experiment

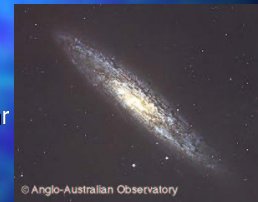
- deep HI observations
 - e.g., observe 3 x 12 hours with various arrays (375, 750, 1.5)
 - calibrate and combine data
 - find HI emission / absorption
 - make channel maps (movies)
 - make moment maps etc.

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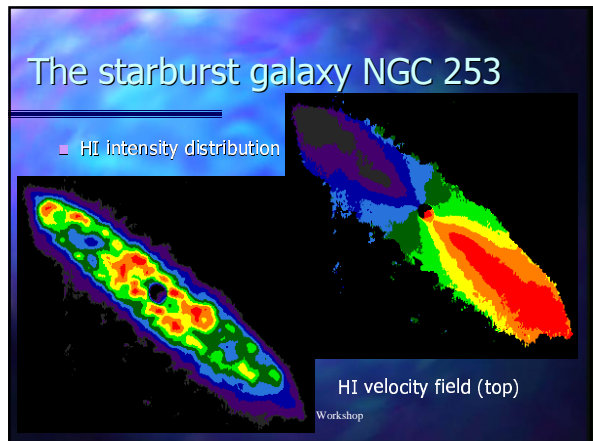
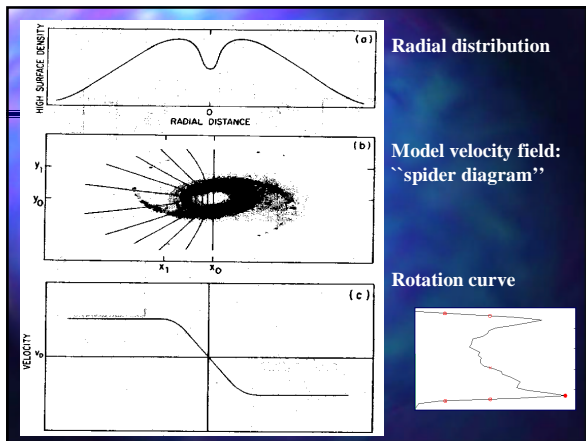
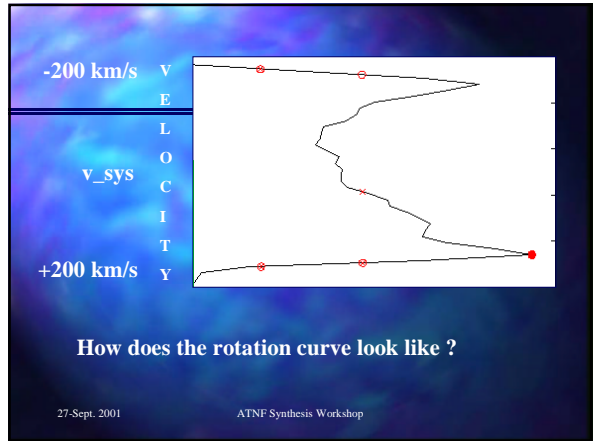
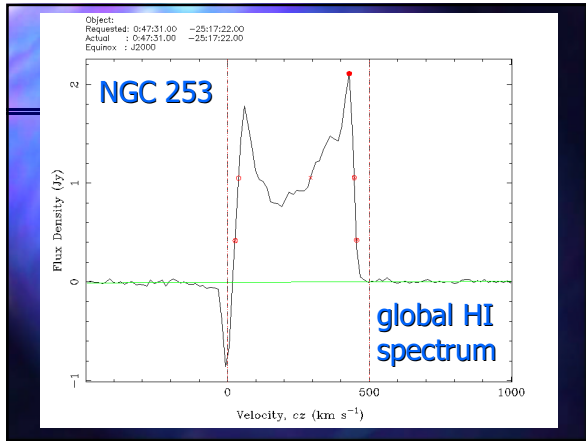
The starburst galaxy NGC 253

- bright spiral galaxy
- edge-on
- member of the Sculptor Group
- large amount of star formation in the nuclear region

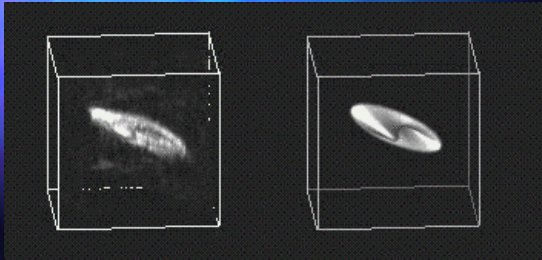


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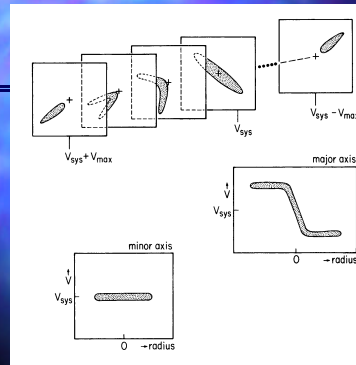
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NGC 253 movie_(program krot)



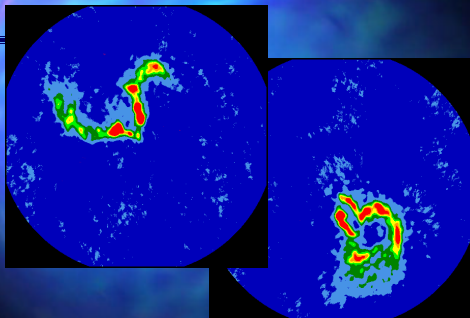
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Channel maps of a model galaxy
 Position velocity diagrams along
 a) the major axis
 b) the minor axis

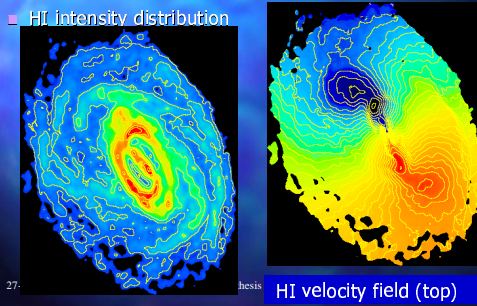
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The Circinus Galaxy: channel maps



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The Circinus Galaxy



HI intensity distribution
 HI velocity field (top)

The Circinus Galaxy

- in ZOA, $b = -4$ degr
- optically obscured
- only discovered in 1977 by K. Freeman and collaborators
- starburst galaxy
- active nucleus
- strong masers

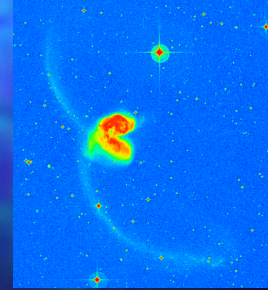


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The galaxy pair NGC4038/9

- "The Antennae"
- nearby pair of merging galaxies
- prominent tidal tails in the optical and HI
- star formation in the nuclear disks
- one companion
- new dwarf galaxy in formation

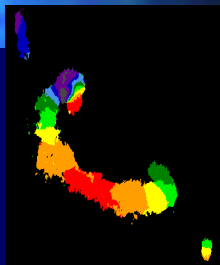
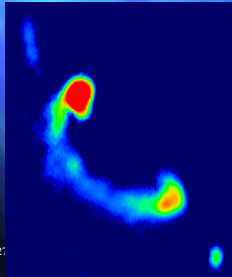


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The galaxy pair NGC4038/9

- HI intensity distribution



HI velocity field (top)

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