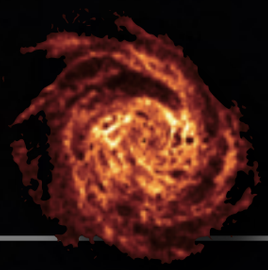


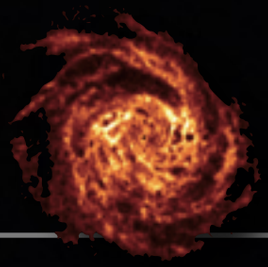
Challenges for visualisation in spectral line astronomy

Thijs van der Hulst
Kapteyn Astronomical Institute

university of groningen / Kapteyn Astronomical Institute

APERTIF

erc



Challenges for visualisation in spectral line astronomy

Thijs van der Hulst
Kapteyn Astronomical Institute

- Exploring the signatures of HI in galaxies
- Enhancing modelling of HI structures
- Providing an affordable and fast environment
- Avoiding diversity of tools

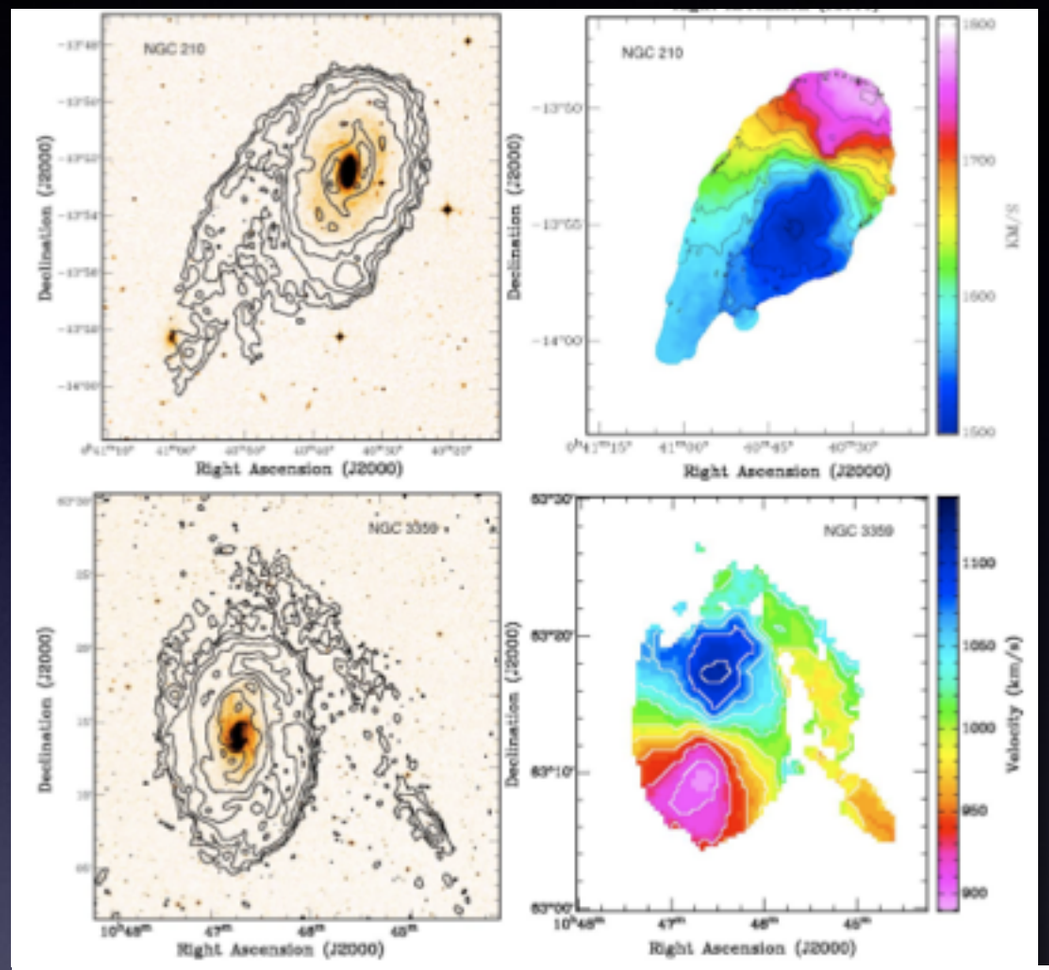
university of groningen / Kapteyn Astronomical Institute

APERTIF

erc

Signatures: evidence for cold accretion?

Sancisi+ 2008



sustaining star formation

-

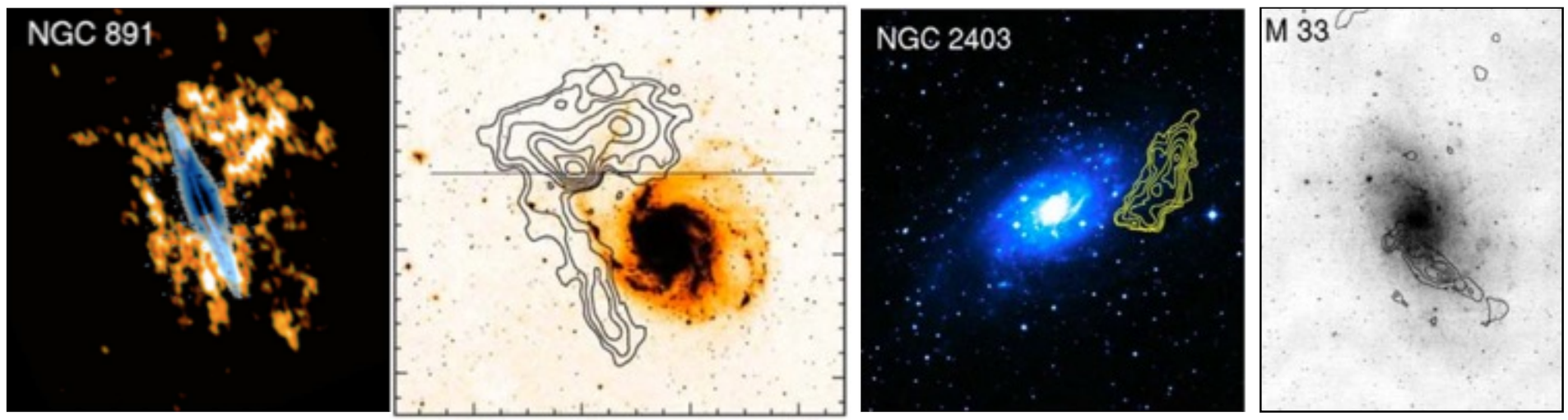
building up stellar mass

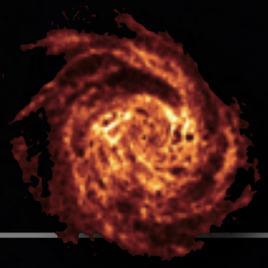
Evidence for cold accretion

or

Galactic Fountain / Fallback?

Oosterloo+ 2007

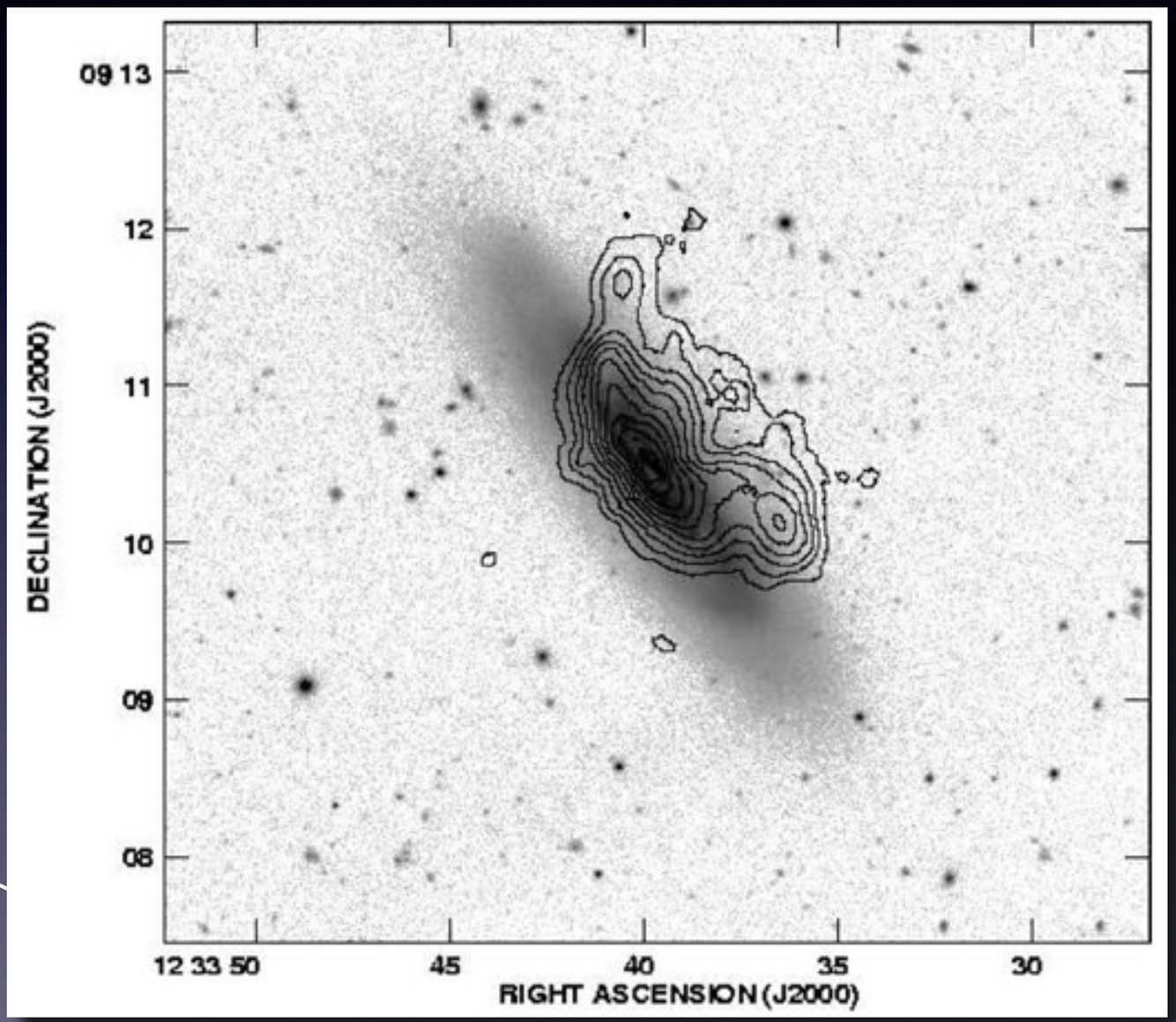




Signatures: tails and major distortions

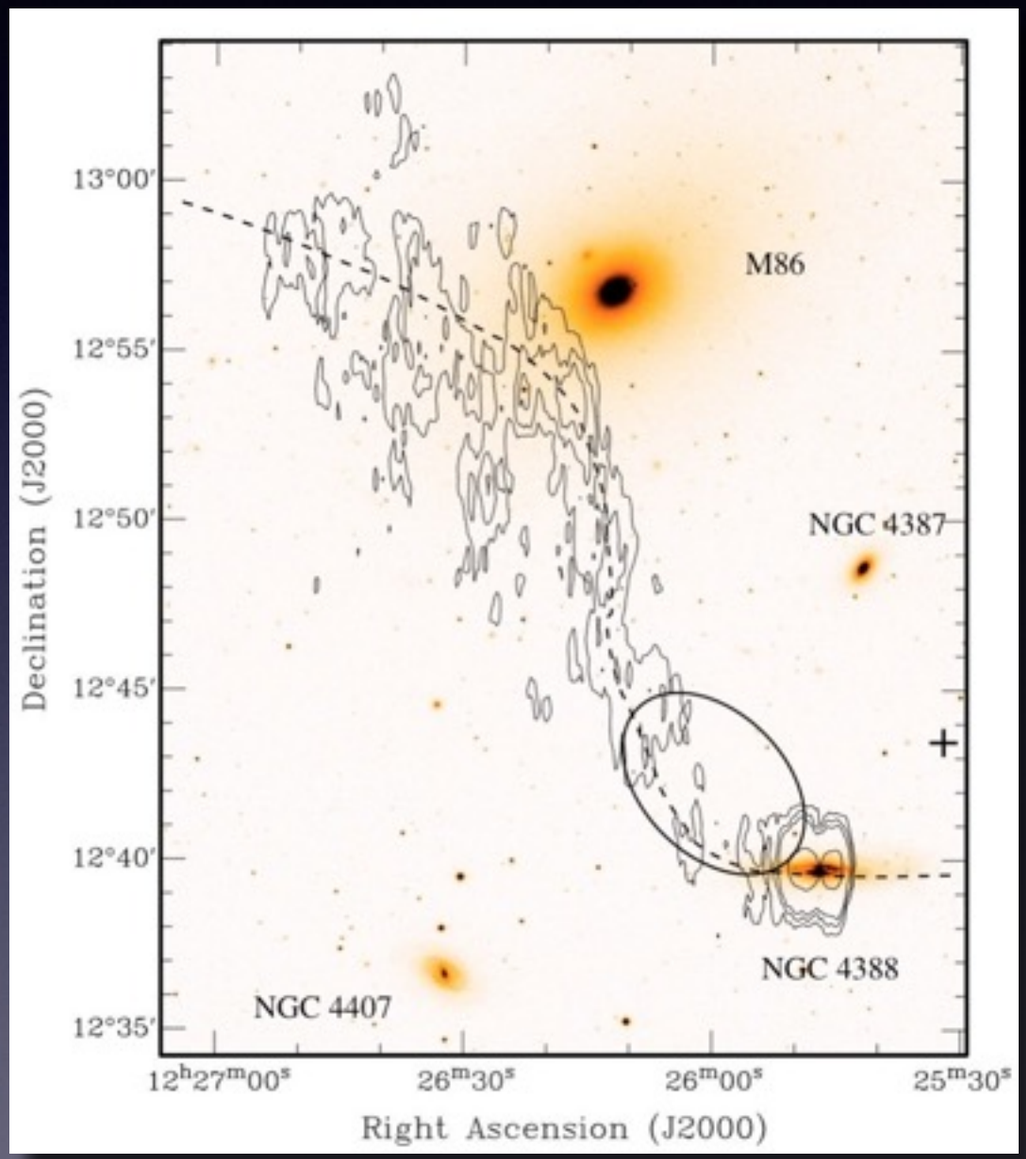
Ram Pressure Stripping in the VIRGO Cluster

NGC 4522



Kenney+ 2004

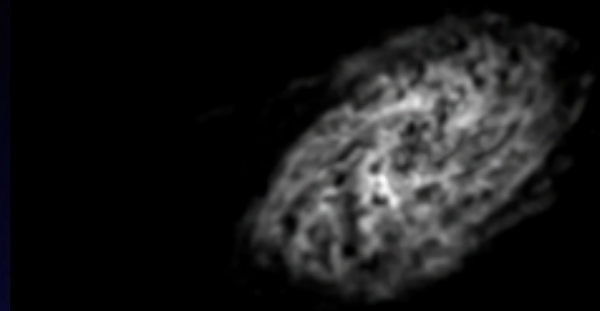
NGC 4388



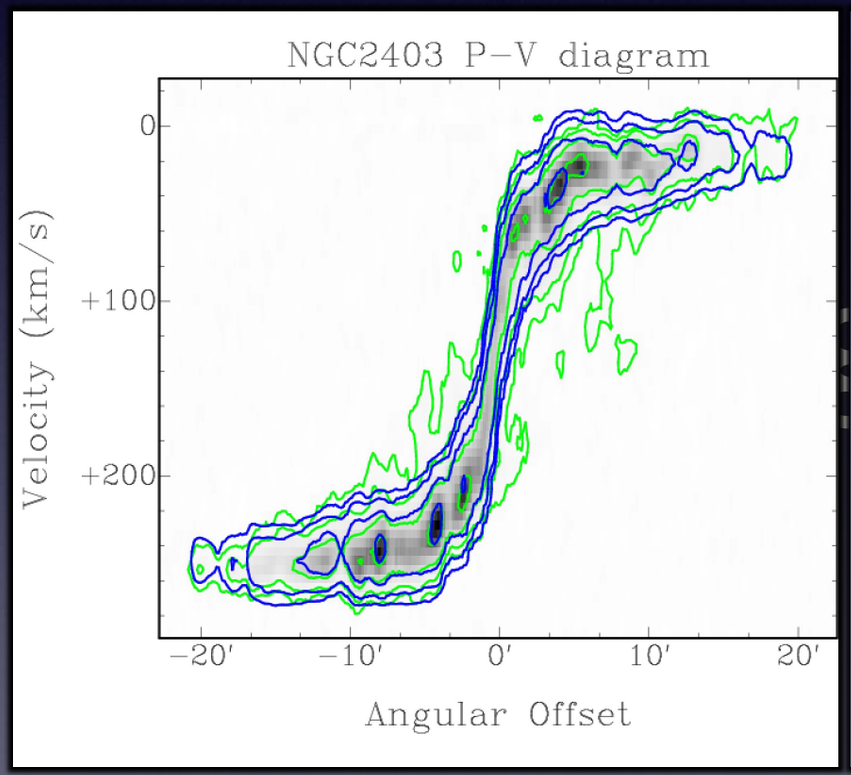
Oosterloo & van Gorkom, 2005

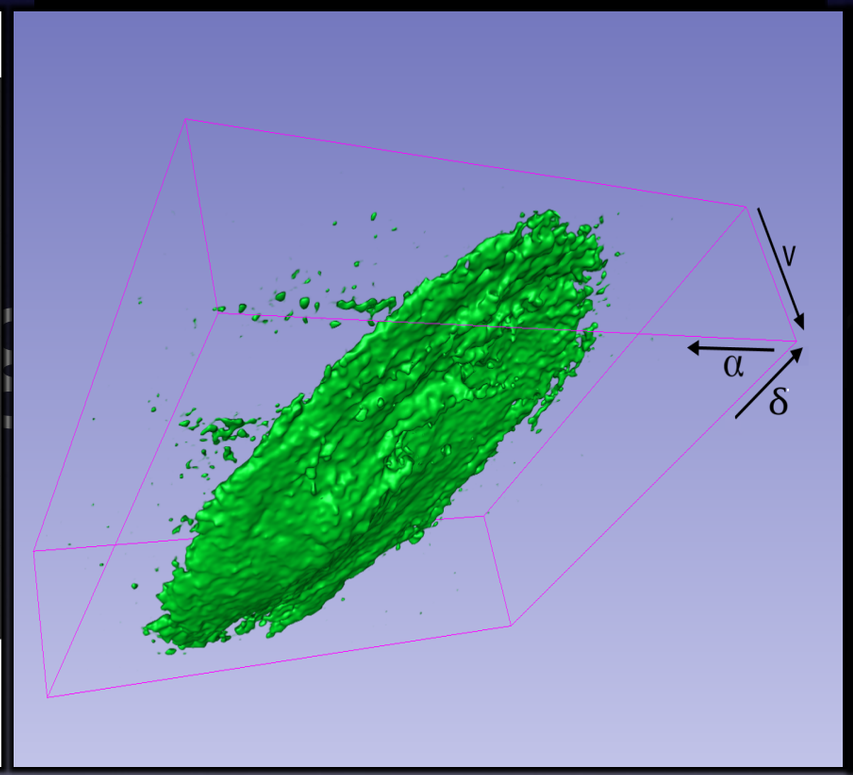
Signatures: anomalous velocity gas

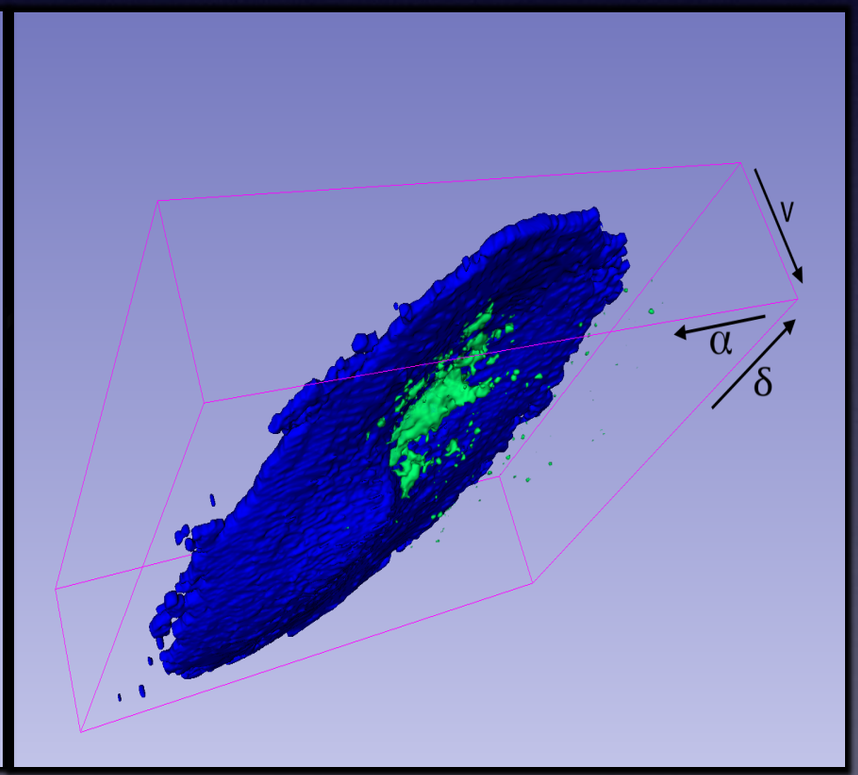
NGC 2403



rendering by Punzo



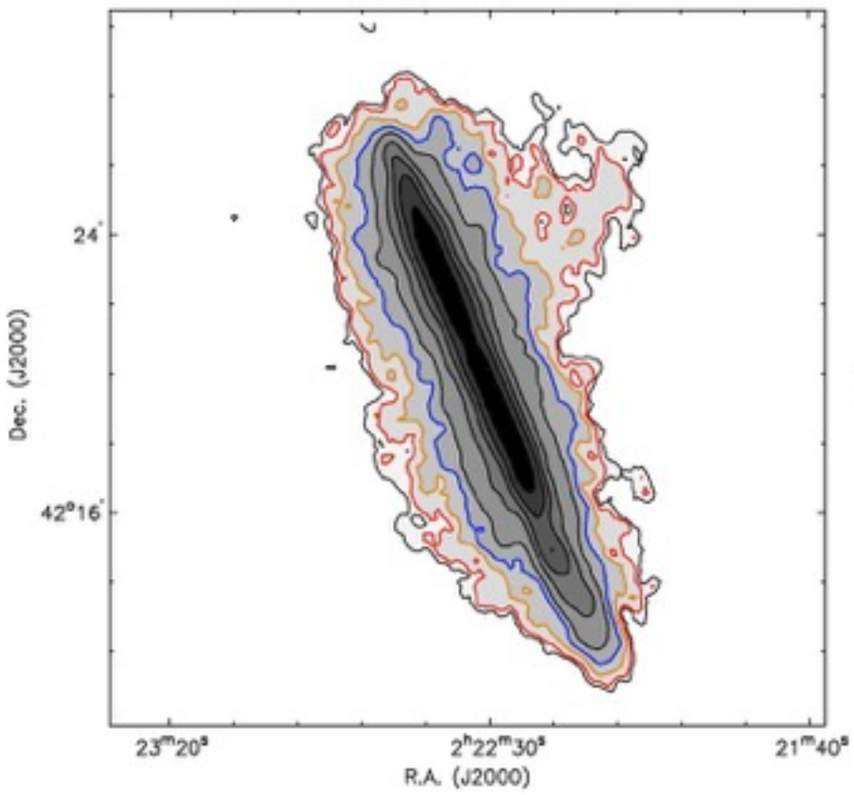




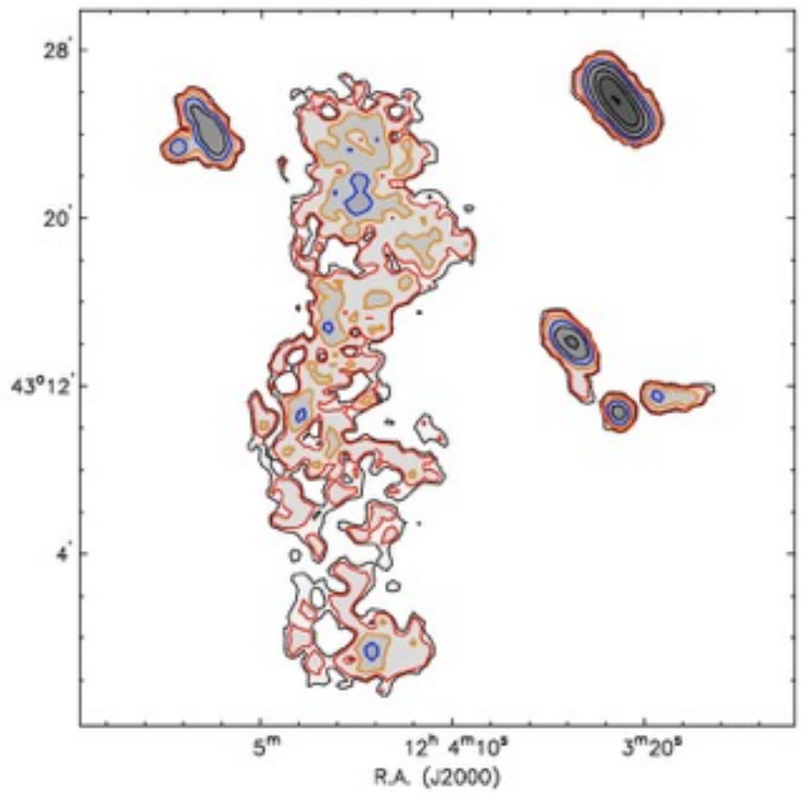
separate non-circularly rotating (extra-planar) gas (green) from the rotating disk by using a model to describe the disk (blue)

Signatures: summary

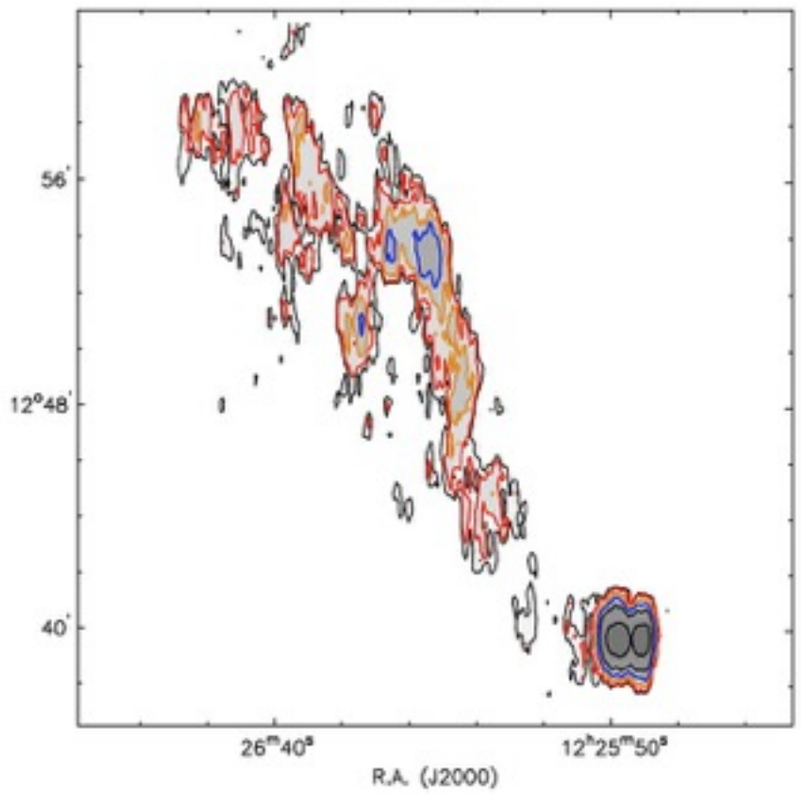
extraplanar gas



tidal filaments



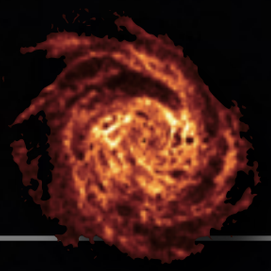
ram-pressure tails



Common to all of these tell-tale signatures:

- low column density
- unusual kinematics

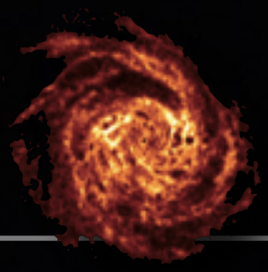
good visualisation techniques can uncover these easily



Visualisation: basic meaning

- To form a picture of someone or something in your mind, in order to imagine or remember him, her, or it
- Making a visible presentation of numerical data, particularly a graphical one
- Visualization is the process of representing abstract business or scientific data as images that can aid in understanding the meaning of the data

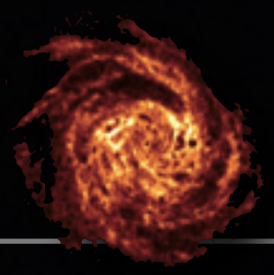
*But here: presenting 1-D, 2-D, 3-D and n-D data in a comprehensive way and be able to **interact** with the data so concentrate on **desktop** solutions*



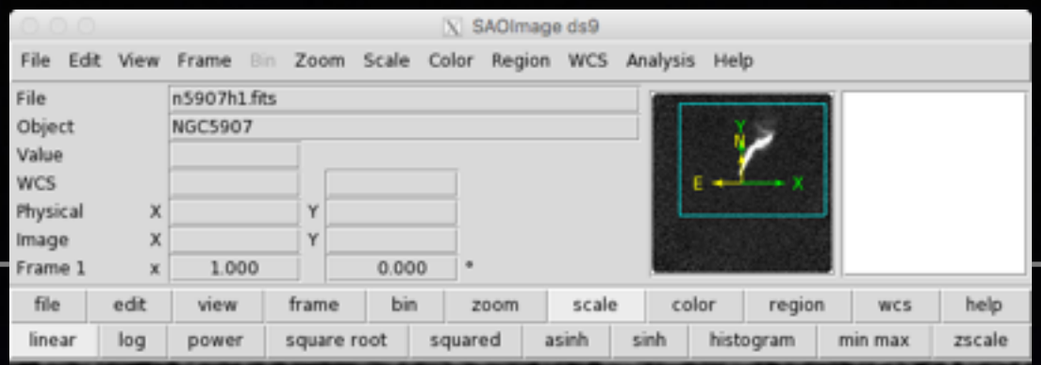
Visualisation: available 3-D viewers

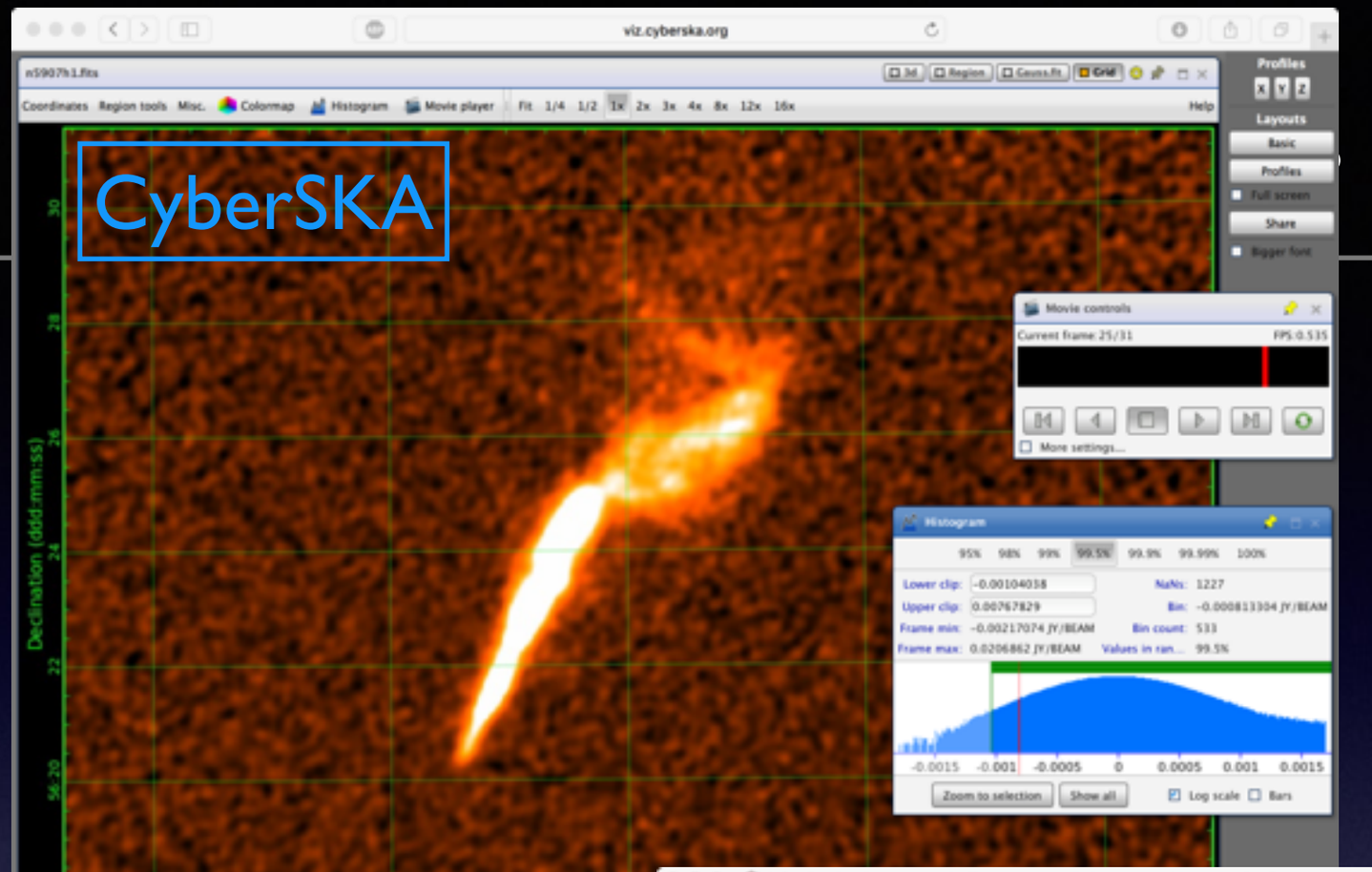
Karma (kvis, kpvslice, etc.)
Gipsy viewers (sliceview, visions)
CASA viewer
DS9
Viewer in CyberSKA for uploaded data
QFitsView
FITS3D
VO: Alladin + HiPS (*Hierarchical Progressive Surveys*)
TopCat (for table data)
Volume rendering: Frelled (uses Blender)
FITS3D (Victoria U. Wellington NZ)
S2PLOT (Swinburne)
VAA3D (hhmi Howard Hughes Medical Institute)
MayaVi

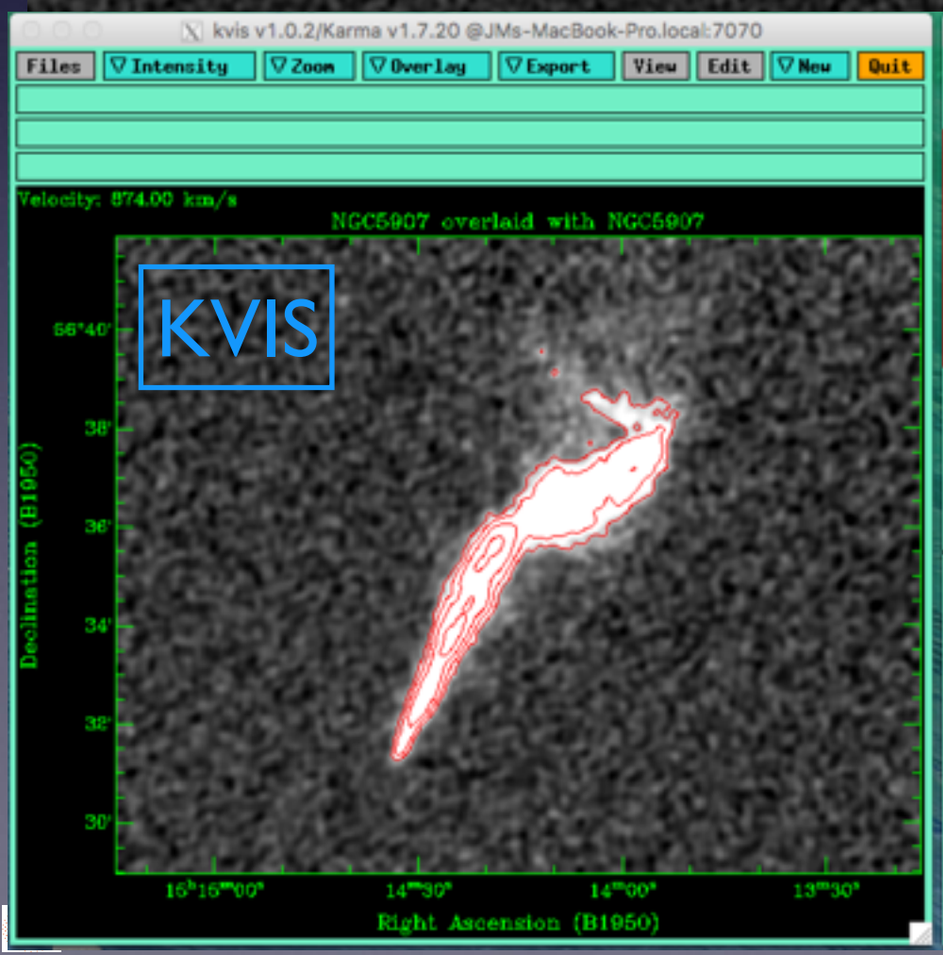
Visualisation: available FITS viewers

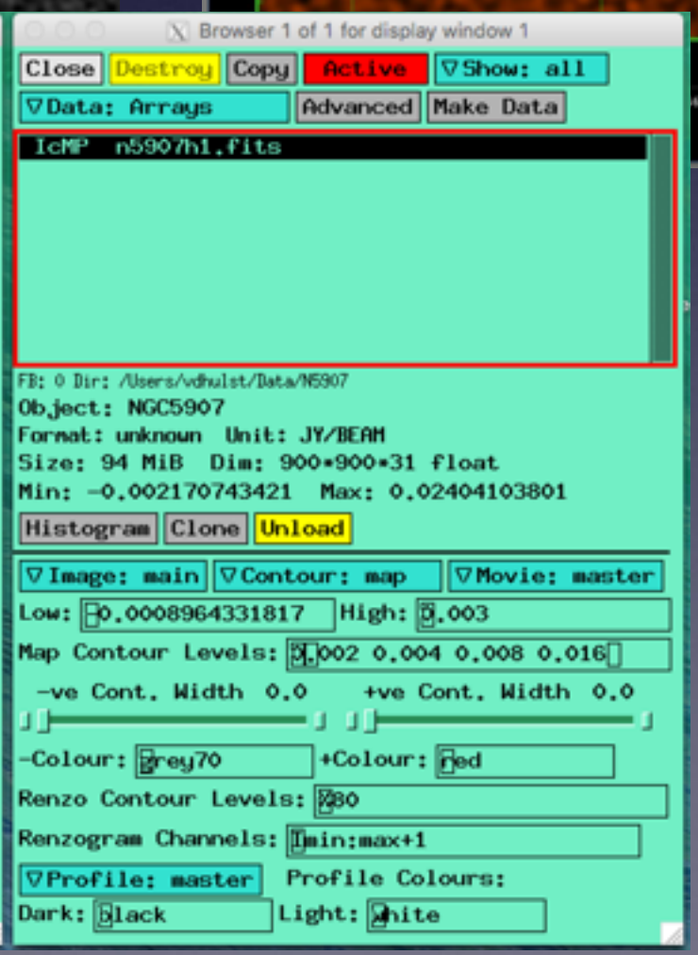


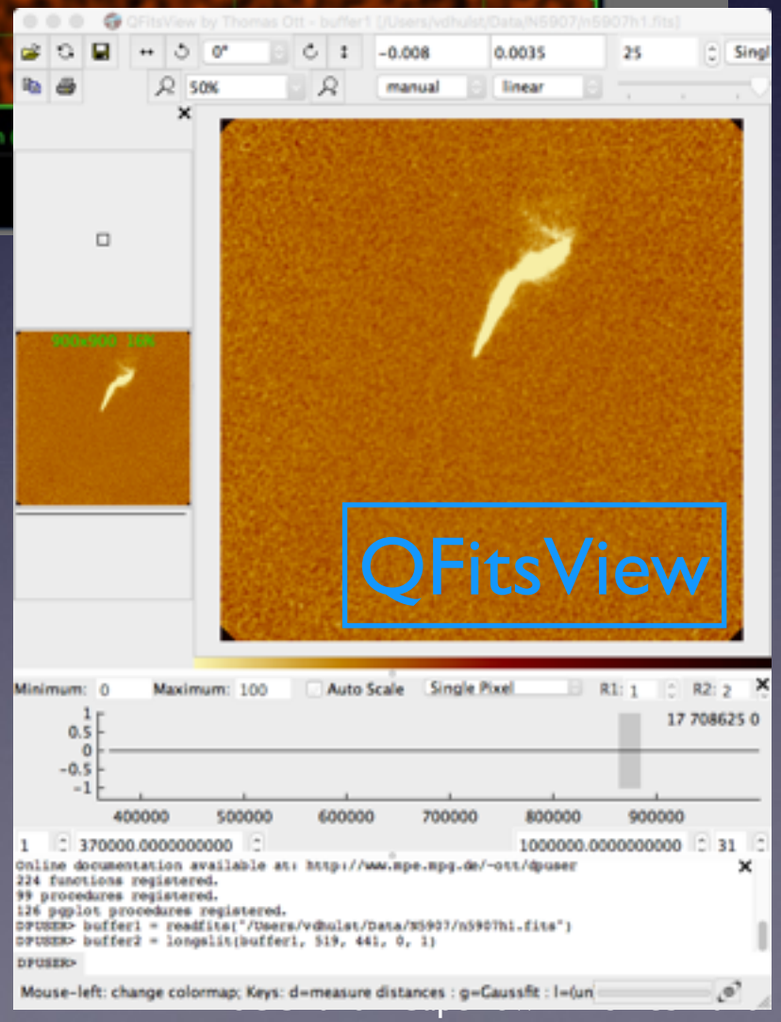
Visualisation: commonly used 3-D viewers


SAOImage ds9
File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help
File n5907h1.fits
Object NGC5907
Value
WCS
Physical X Y
Image X Y
Frame 1 x 1.000 0.000
file edit view frame bin zoom scale color region wcs help
linear log power square root squared asinh sinh histogram min max zscale
DS9

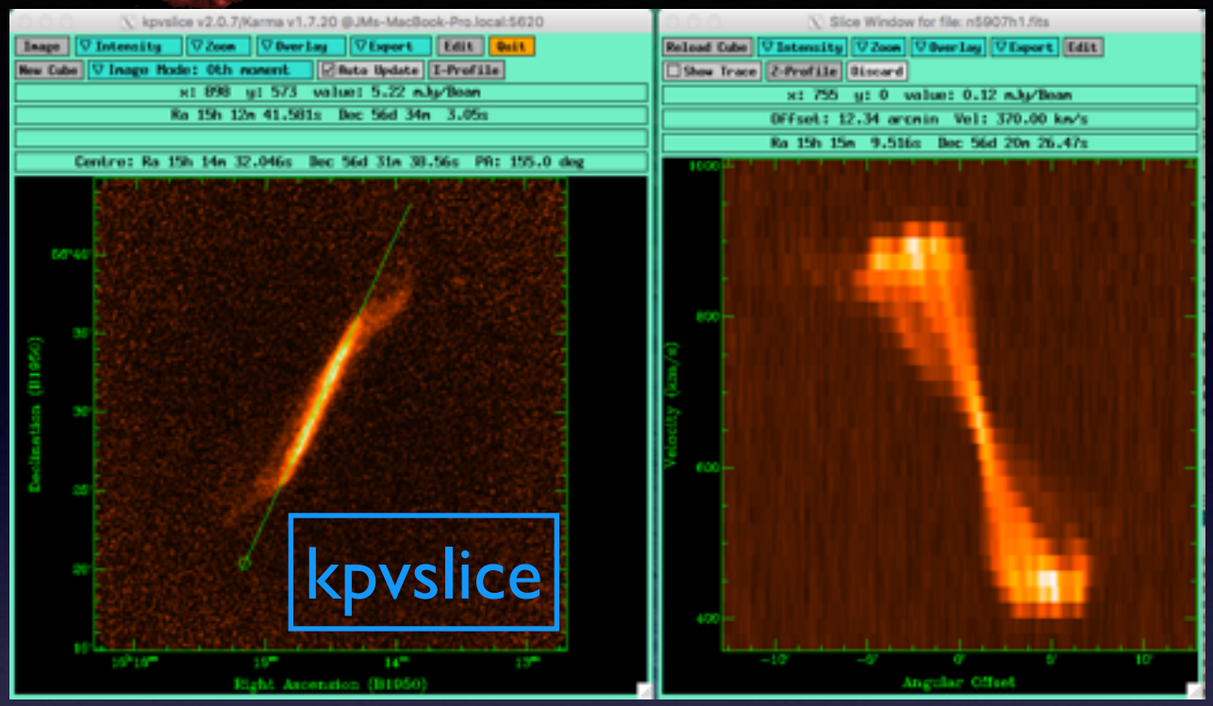

viz.cyberska.org
CyberSKA
Declination (ddd:mm:ss)
Movie controls
Histogram
Profiles
Layouts

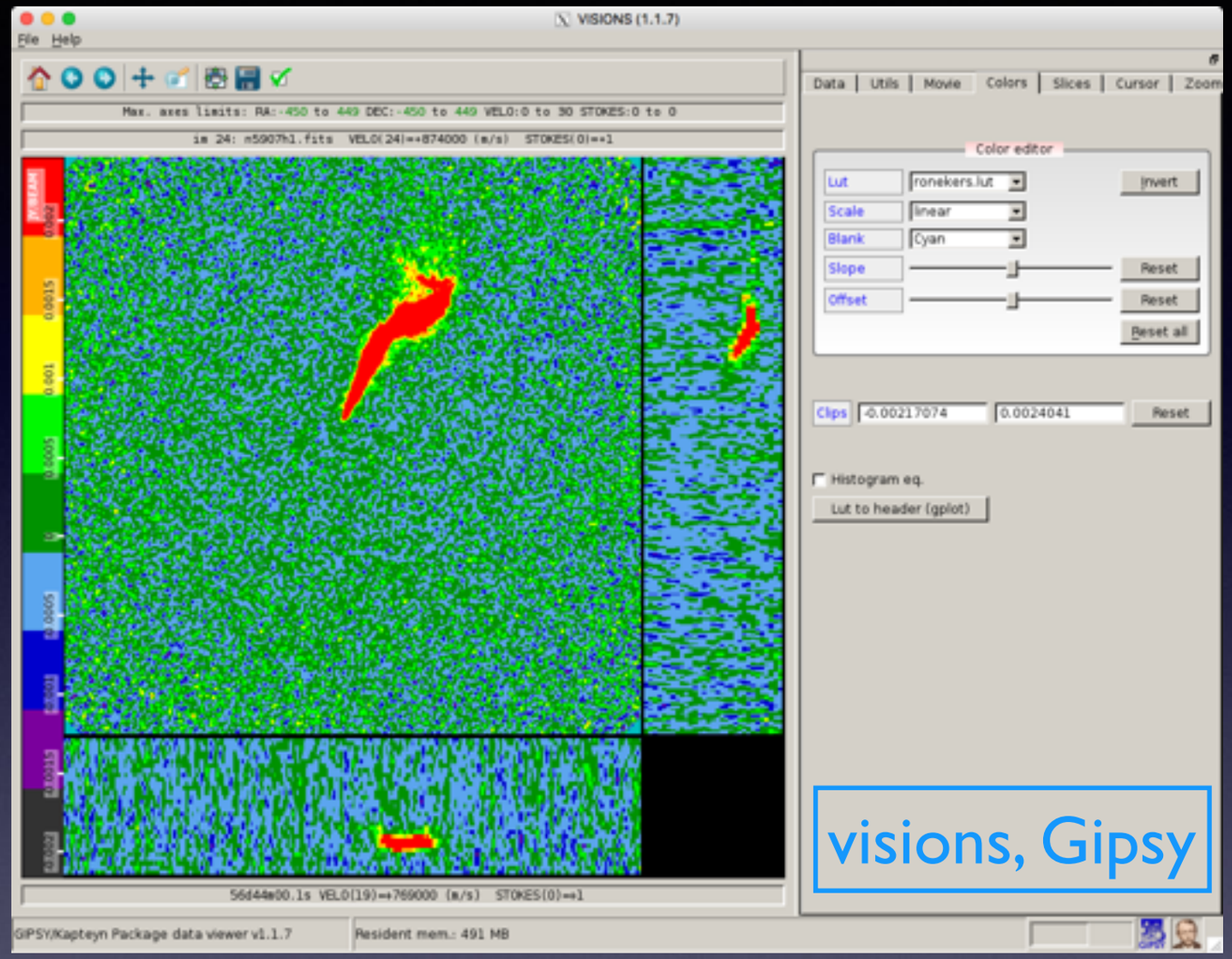

kvis v1.0.2/Karma v1.7.20 @JMs-MacBook-Pro.local:7070
Files Intensity Zoom Overlay Export View Edit New Quit
Velocity: 874.00 km/s
NGC5907 overlaid with NGC5907
KVIS
Declination (B1950)
Right Ascension (B1950)


Browser 1 of 1 for display window 1
Close Destroy Copy Active Show: all
Data: Arrays Advanced Make Data
IcMP n5907h1.fits
Object: NGC5907
Format: unknown Unit: JY/BEAM
Size: 94 MiB Dim: 900*900*31 float
Min: -0.002170743421 Max: 0.02404103801
Histogram Clone Unload
Image: main Contour: map Movie: master
Low: 0.0008964331817 High: 0.003
Map Contour Levels: 0.002 0.004 0.008 0.016
-ve Cont. Width 0.0 +ve Cont. Width 0.0
-Colour: grey70 +Colour: red
Renzo Contour Levels: 280
Renzogram Channels: min:max+1
Profile: master Profile Colours:
Dark: black Light: white


QFitsView by Thomas Ott - buffer1 (/Users/vdhulst/Data/N5907/n5907h1.fits)
QFitsView
Online documentation available at: http://www.mpe.mpg.de/~ott/dpuser
224 functions registered.
99 procedures registered.
126 pgplot procedures registered.
DPUSER> buffer1 = readfits('/Users/vdhulst/Data/N5907/n5907h1.fits')
DPUSER> buffer2 = longslit(buffer1, 519, 441, 0, 1)
DPUSER>

Visualisation: commonly used 3-D viewers





3-D Viewers:

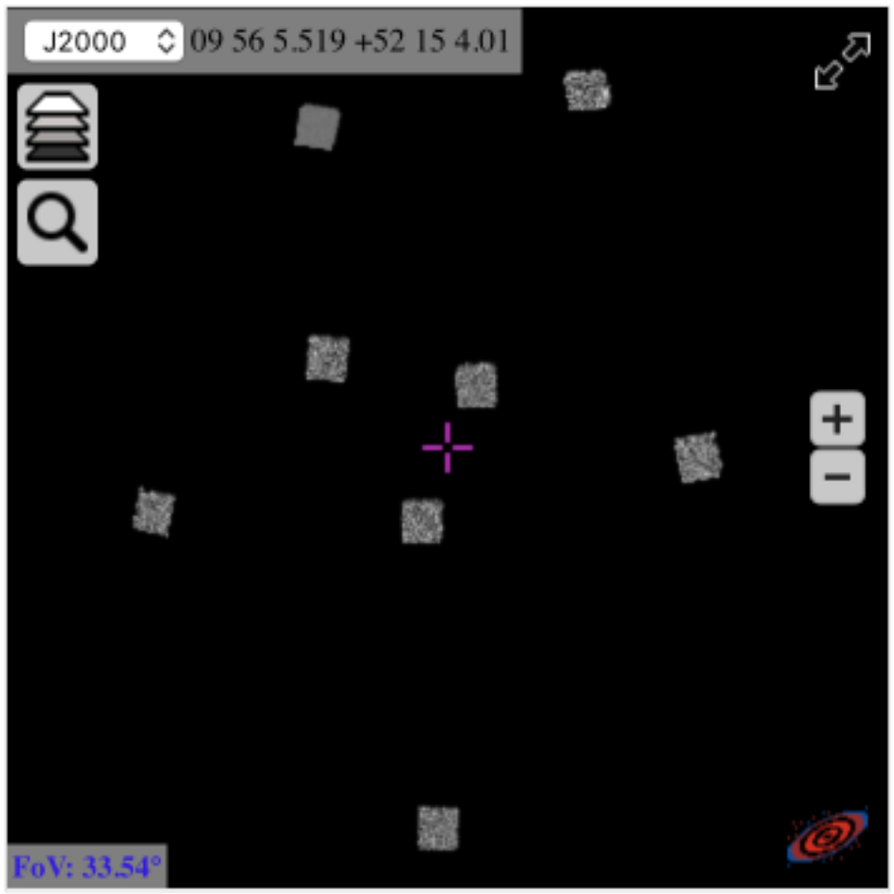
- basic features present
- handling very diverse
- few can combine multiple data (kvis)
- few can display 3 dimensions at once (kpvslice, visions)
- few are coupled directly to the data analysis environment

Visualisation: first HI data in VO

amiga.iaa.es

"WHISP-sample" progressive survey

This Web resource contains HiPS(*) components for **WHISP** progressive survey.



- **Label:** WHISP-sample
- **Type:** HiPS cube (127 frames)
- **Best pixel angular resolution:** 6.442"
- **Max tile order:** 6 (NSIDE=64)
- **Available encoding tiles:** png fits
- **Tile size:** 512x512
- **FITS tile BITPIX:** 16
- **Processing date:** 2015-06-08T09:51Z
- **HiPS builder:** Aladin/HipsGen v8.148
- **Coordinate frame:** equatorial
- **Sky area:** 0.452% of sky => 186.3Â°^2
- **Associated coverage map:** MOC
- **Original data access template:** metadata.xml
- **Raw property file:** properties
- **Base URL:**

http://amiga.iaa.es/HiPS/3DCollections/WHISP

This survey can be displayed by Aladin Lite (see above), by Aladin Desktop client (just open the base URL) or any other HiPS aware clients .

(*) The HiPS technology allows a dedicated client to access an astronomical survey at any location and at any scale. HiPS is based on HEALPix sky tessellation and it is designed for astronomical scientifical usages (low distorsion, true pixel values...).HiPS technical documentation is available here

Verdes Montenegro et al., IAA, Grenada (*http://amiga.iaa.es/HiPS/3DCollections/WHISP/*)

Visualisation: first HI data in VO

amiga.iaa.es

"WHISP-sample" progressive survey

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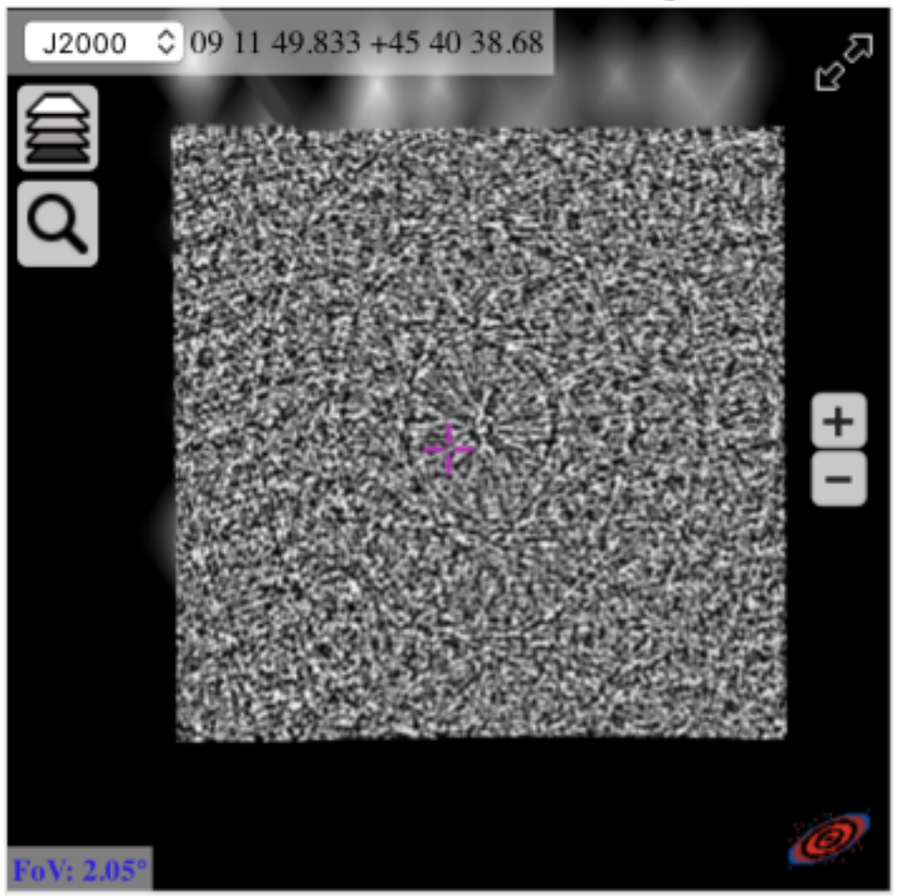

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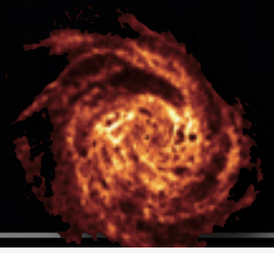
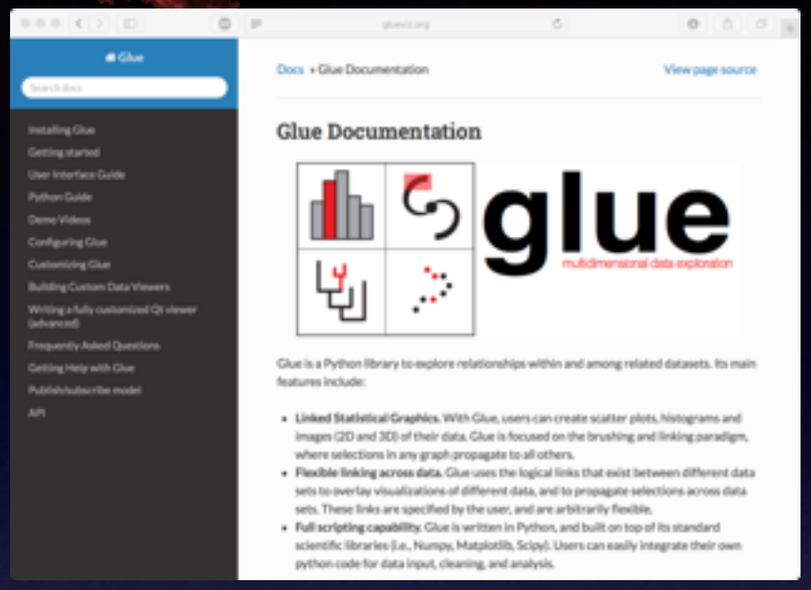
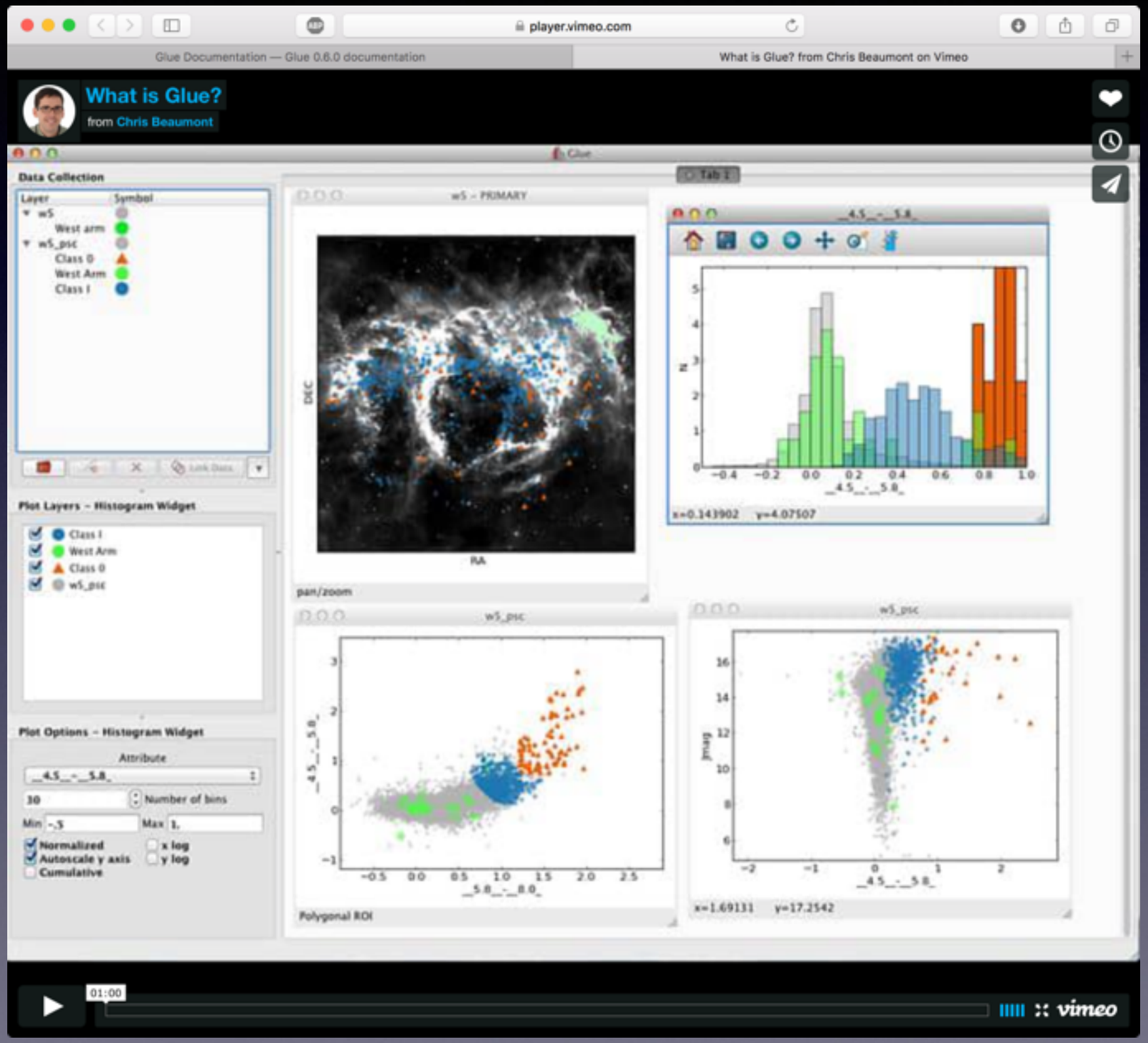


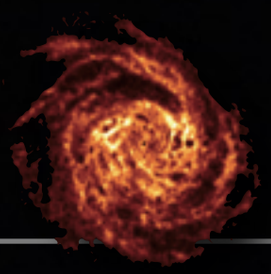
Visualisation: linked displays

The Glue Project
by Chris Beaumont

linked views of data

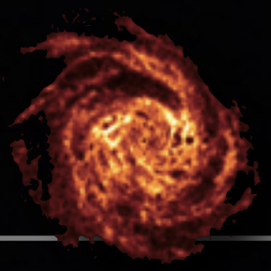






Visualisation: summary

- many existing viewers
- most are standalone
- some can read several different formats
- very few provide good volume rendering (expensive)
- connecting 3-D data to VO is happening just now
- Karma probably the most versatile, despite its age

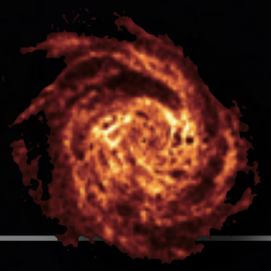


Visualisation: what is missing?

- fast and flexible volume rendering
- interaction with the data via the visualisation tools
- linked 1-D, 2-D and 3-D displays
- interactive coupling to models of the data

Ongoing work in Groningen:

adding these features to an existing 3D visualisation platform 3D Slicer (talk by Davide Punzo)



Visualisation: let's get to work

Thank You