The Flows of Neutral Hydrogen in the Grand Design Spiral Galaxy M83

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Overview

- Extra-planar gas and link with galaxy evolution
- M83: why study this particular galaxy and what are we looking for?
- Tilted Ring Modelling and TiRiFiC
- Results
- Implications and Future Work

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)
Extra-planar Neutral Hydrogen
Why M83?

The Local Volume HI Survey (LVHIS)
The HI Nearby Galaxy Survey (THINGS)

Credit: Robert Gendler and Stephane Guisard
Star Forming Regions

NGC 5236 overlaid with NGC 5236

24 μm Spitzer image
The Lag In NGC 891

Credit: R. Jay GaBany
The Lag In NGC 891

Oosterloo, Fraternali & Sancisi 2007
The Lag In NGC 891

Fraternali et al. 2005
Problem
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The extra-planar gas is assumed to be isotropically distributed – is this assumption correct?
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Is the spiral structure maintained in the extra-planar gas?
M83 (NGC 5236)

HI (red)
FUV (blue)
NUV (green)

Credit: NASA/JPL-Caltech/VLA/MPIA
Integrated Intensity of HI

Integrated Intensity of HI
Integrated Intensity of HI

m83map→1 overlaid with NGC 5236

Right Ascension (J2000)

Declination (J2000)
Tilted Ring Modelling

Credit: Rogstad et al. (1974)

http://www.astron.nl/~jozsa/tirific/
Result

m83map-1

Declination (J2000)

Right Ascension (J2000)

mJy/beam
Result

m83map→l overlaid with NGC 5236

Right Ascension (J2000)

Declination (J2000)
Future Work

- Explore other parameters to see if the anomalous gas is truly extra-planar (such as introducing a lag to the model)

- Separate the radial and vertical motions of the gas in and around the arms, to provide insight into the transport of gas from the outer regions of a galaxy to the inner regions
Extra-planar HI is crucial to understanding galaxy evolution.
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Some spiral structure is seen in the anomalous gas of M83.
Take Away Message

Extra-planar HI is crucial to understanding galaxy evolution.

Some spiral structure is seen in the anomalous gas of M83.

Projection effects may have to be accounted for when calculating the lag in edge-on galaxies.
thank you.

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Credit: NASA/CXC/Curtin University/R.Soria et al.