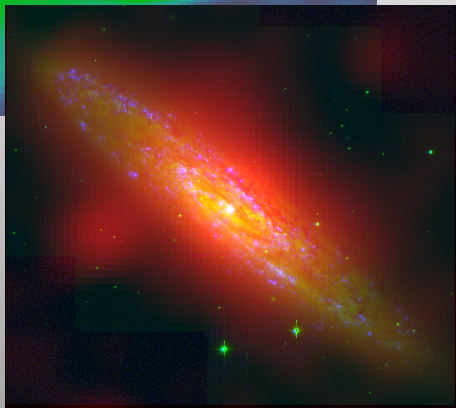
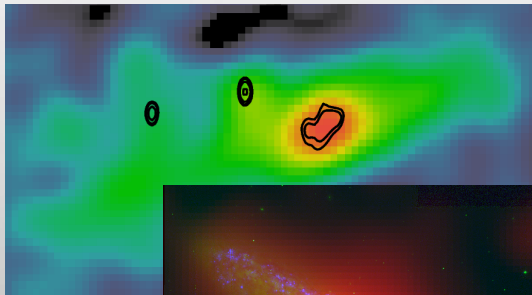




International
Centre for
Radio
Astronomy
Research

Star formation & physical processes in Sculptor Group galaxies at low radio frequencies



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ICRAR, The University of Western Australia



A quick intro & overview

A detailed study of a bunch of local well-studied galaxies
→ near-by & resolved

Broadband radio SEDs: 70 MHz – 11 GHz
→ modelling of the **underlying physical processes**



A quick intro & overview

A detailed study of a bunch of local well-studied galaxies
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Crucial: data from the Murchison Widefield Array (MWA)

GLEAM DR1: 70–230 MHz



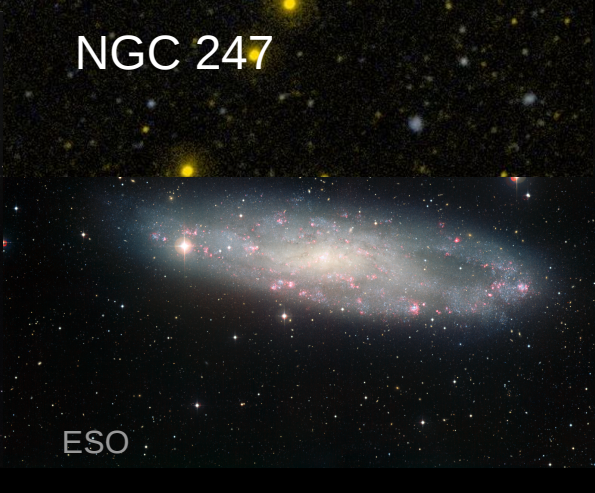
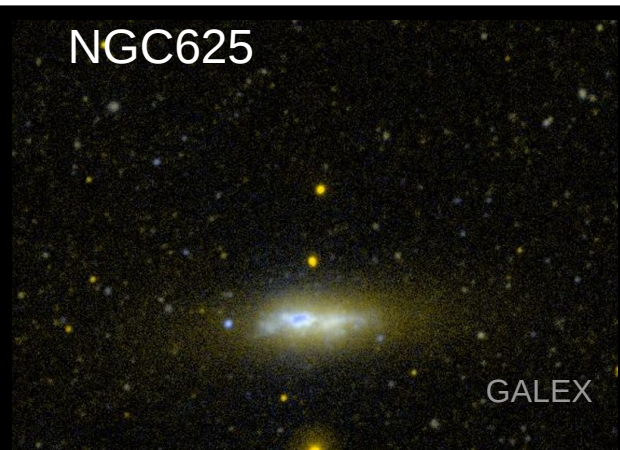
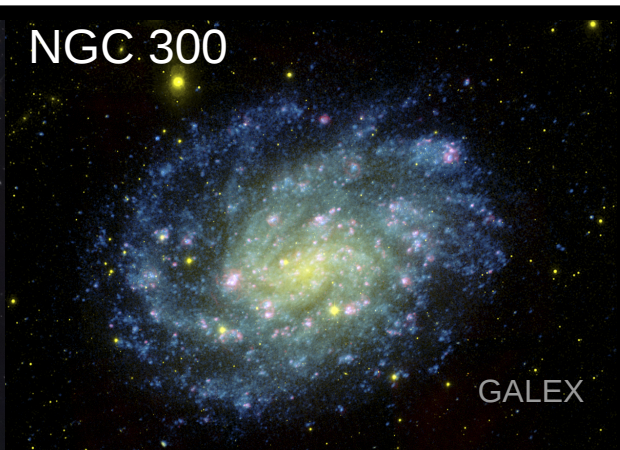
(Hurley-Walker+2017)



Local starburst and star-forming galaxies

Sculptor Group

- loose association, 2 – 4 Mpc away
- close so great laboratory for detailed study

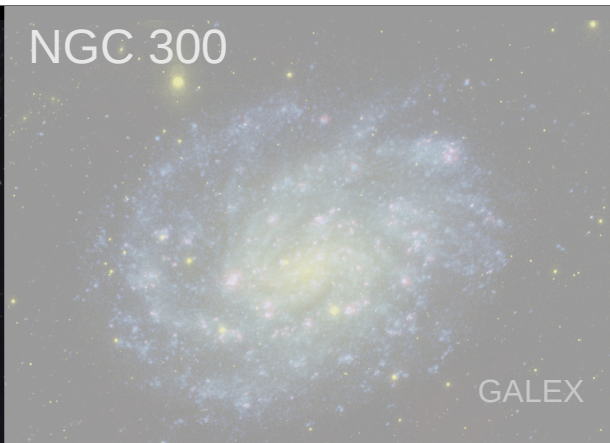




Local starburst and star-forming galaxies

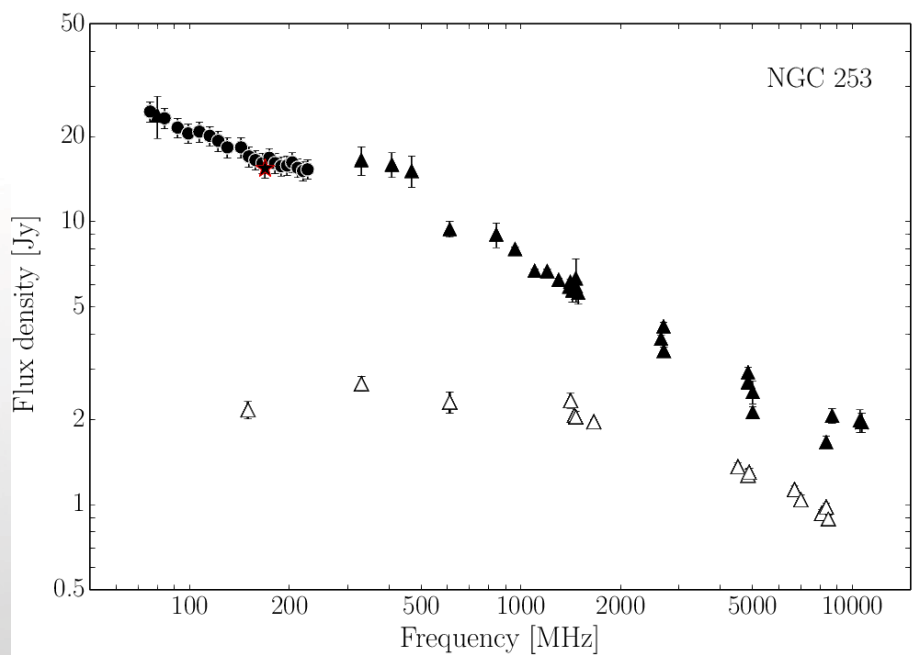
Sculptor Group

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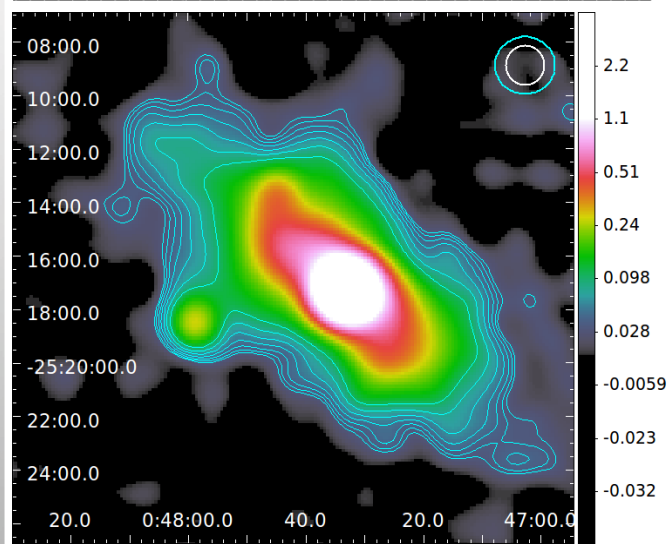
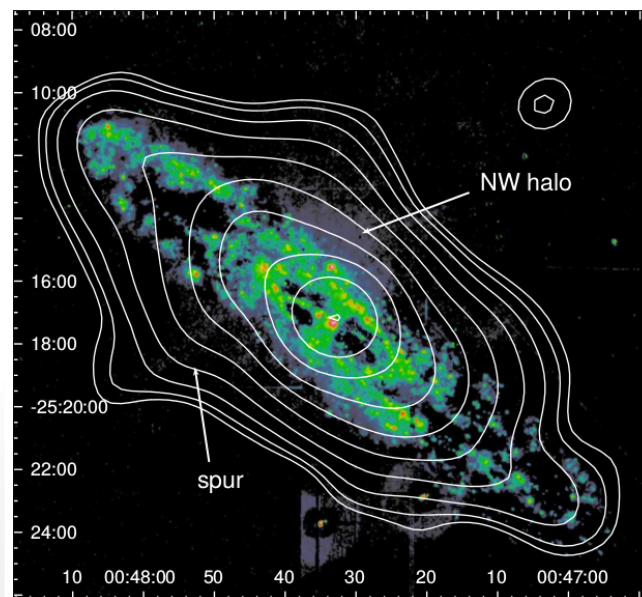


NGC 253 (Sculptor galaxy)



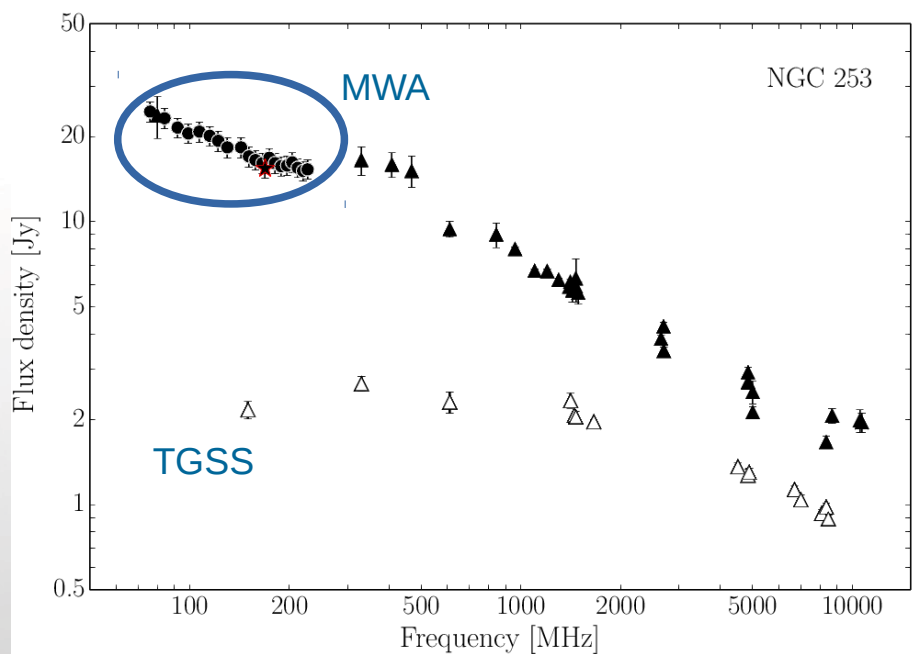
Kapinska+ 2017a

TGSS+GLEAM 150MHz
Credits: Staveley-Smith,
Kapinska



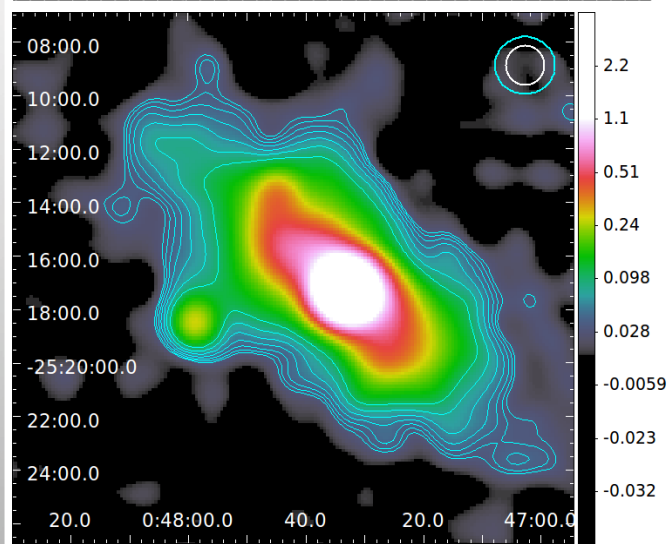
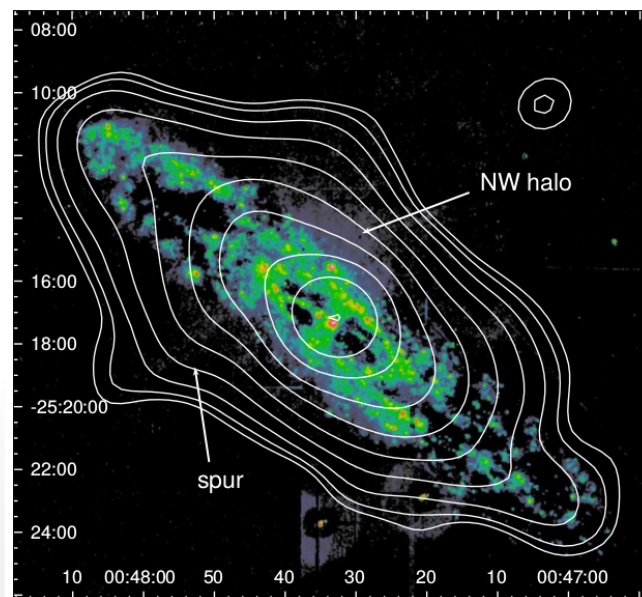


NGC 253 (Sculptor galaxy)



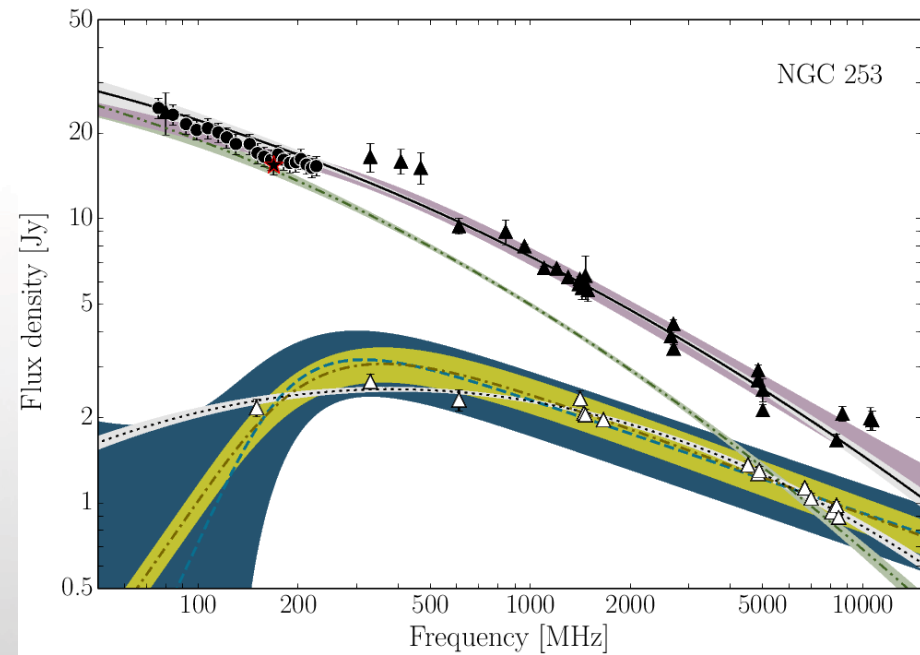
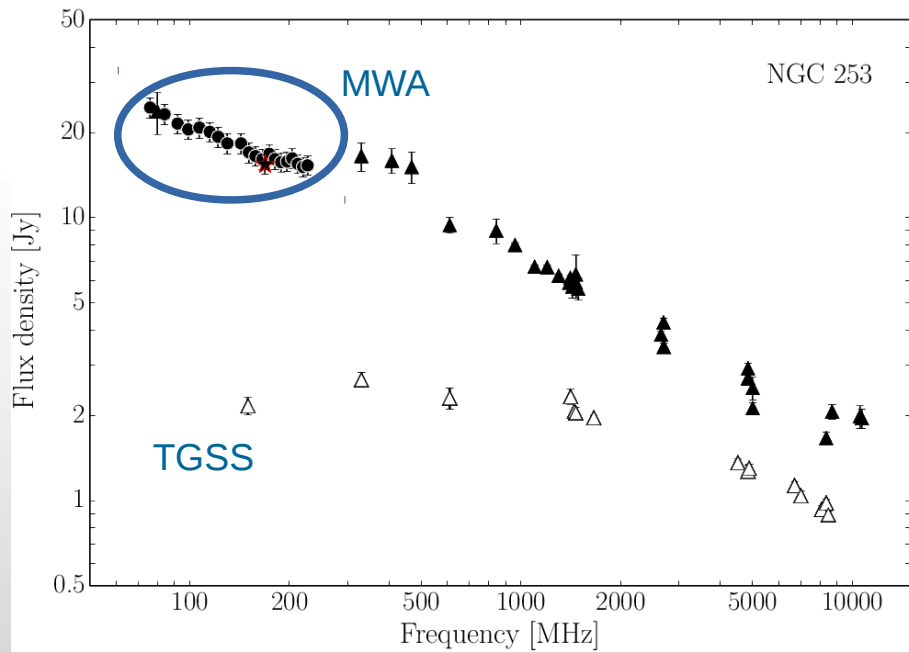
Kapinska+ 2017a

TGSS+GLEAM 150MHz
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Kapinska





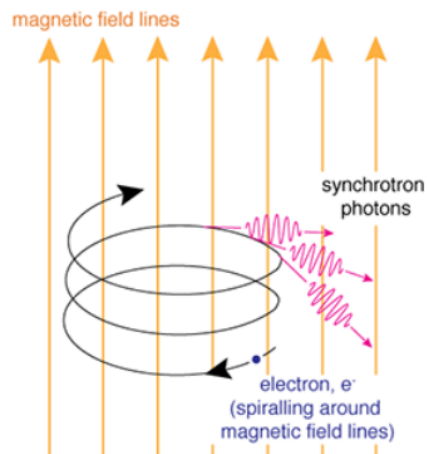
Broadband radio SED of NGC253



Kapinska+ 2017a

Physical processes at radio frequencies

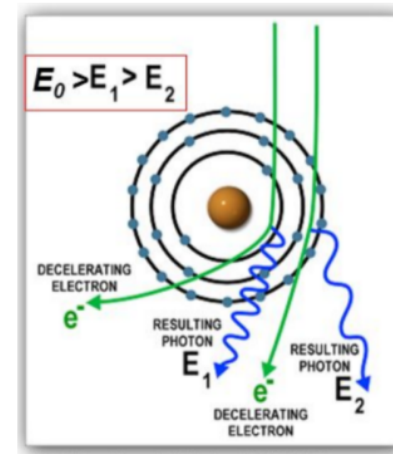
synchrotron emission



absorption at low frequencies
optically thick regime

→ mainly SNR,
also disk winds, jets from
X-ray binaries etc

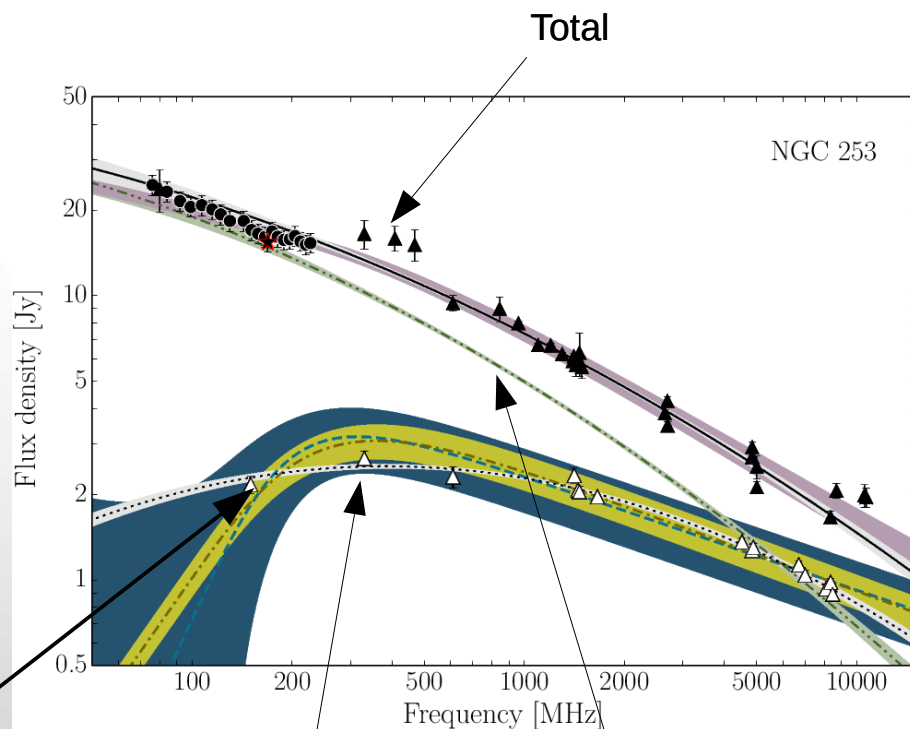
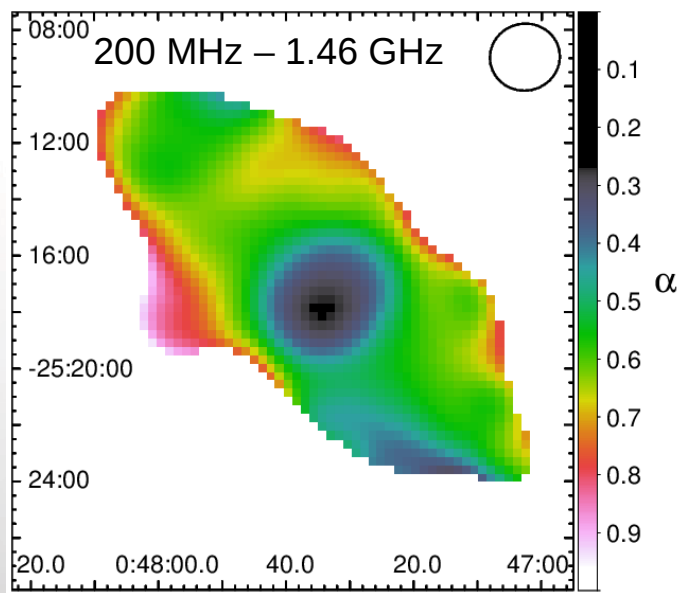
free-free emission



→ HII regions,
ionised medium



Modelling radio SED of NGC 253



Turnover frequency ~ 230 MHz
→ emissivity 4×10^5 pc/cm⁶

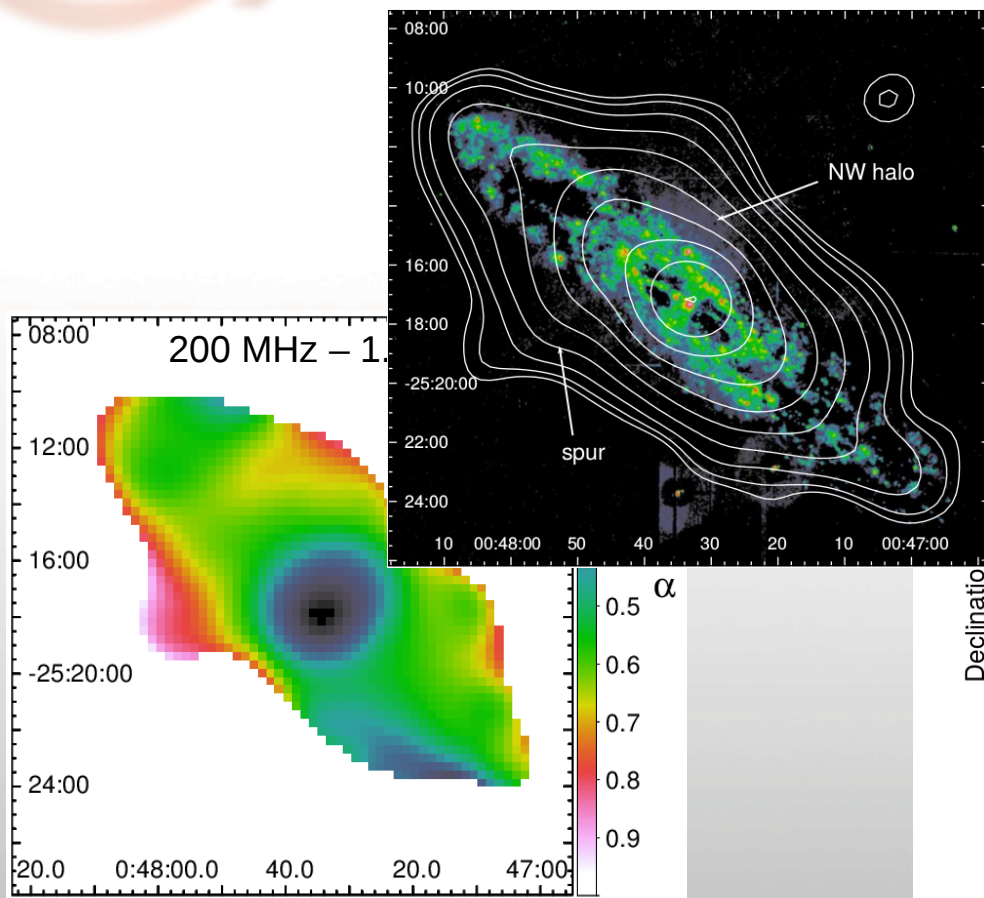
Kapinska+ 2017a

Central
starburst region

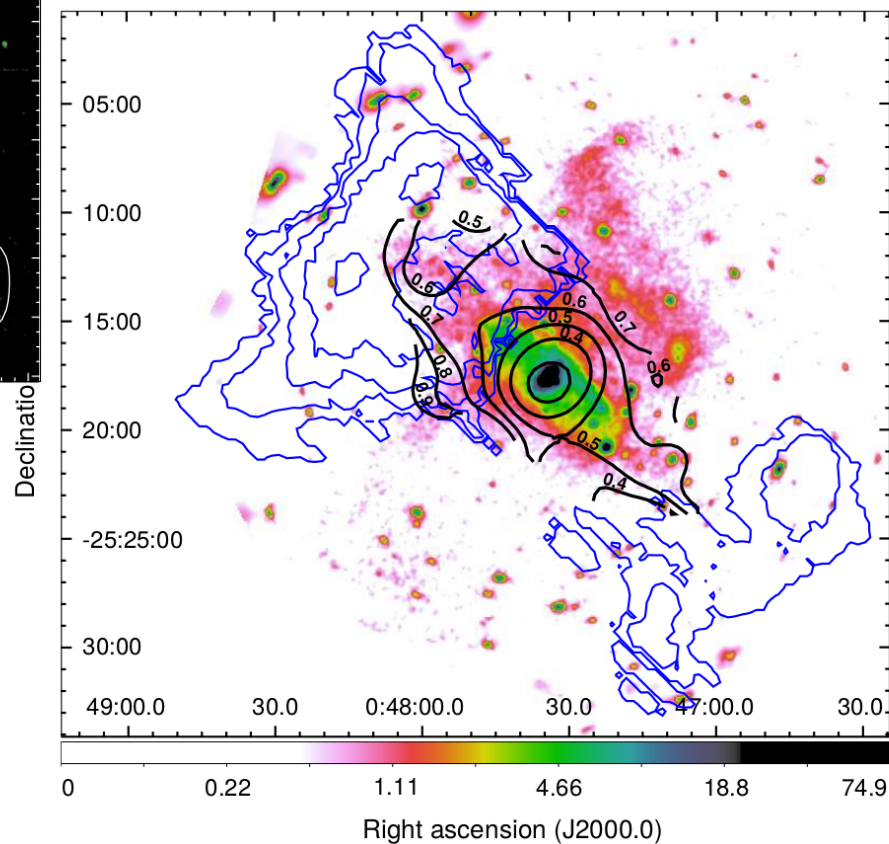
Disk and halo



Synchrotron radio halo of NGC 253



HI (KAT-7; Lucero+2015)
Xrays (0.5-1 keV; Bauer+2008)

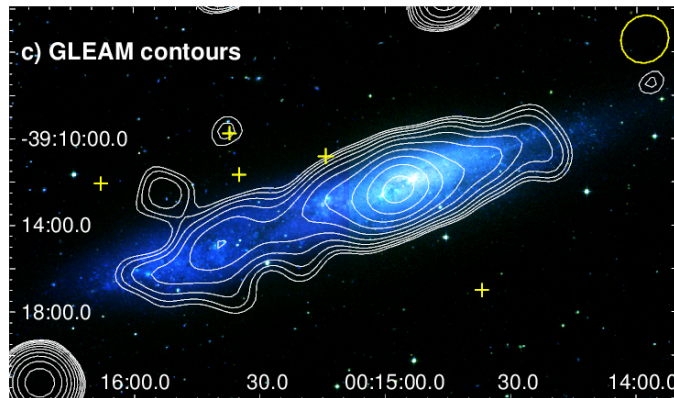
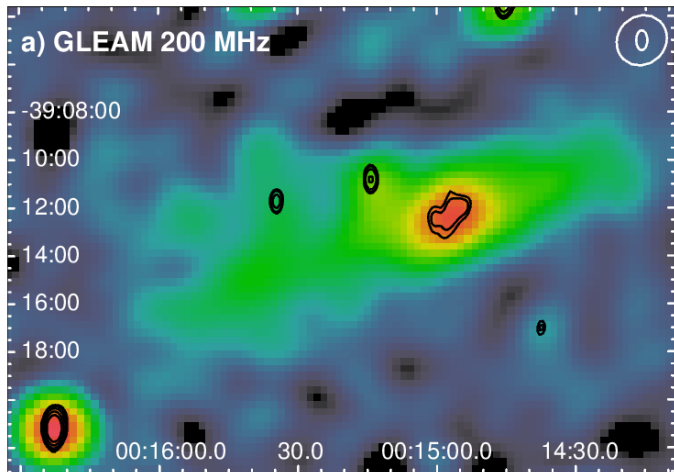


Kapinska+ 2017a

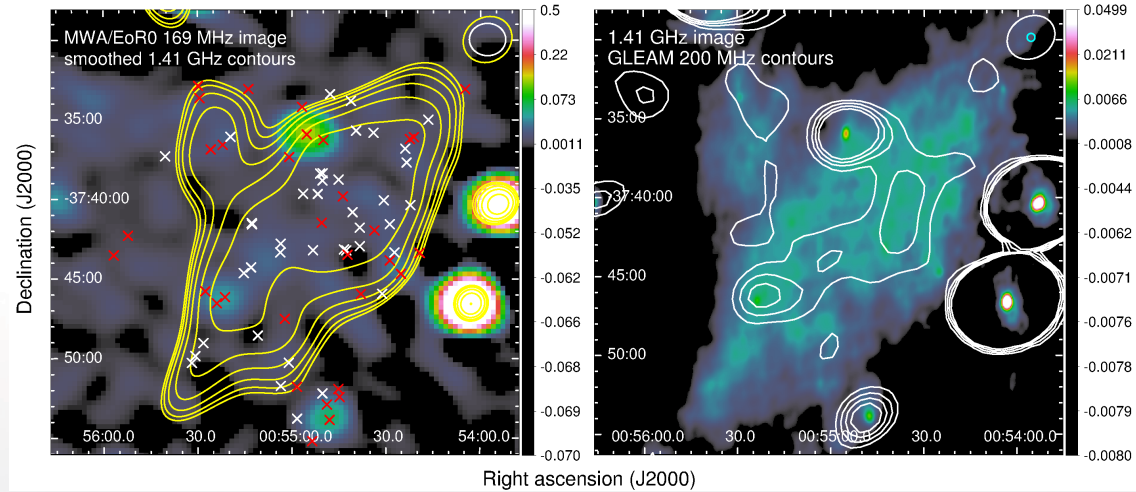


Other detections of Sculptor Group galaxies

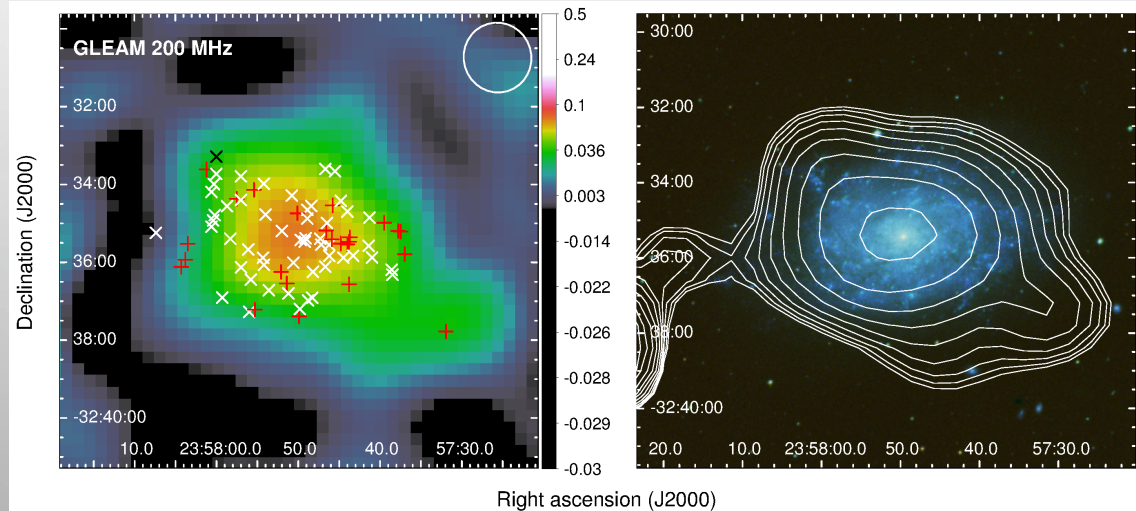
NGC 55



NGC 300



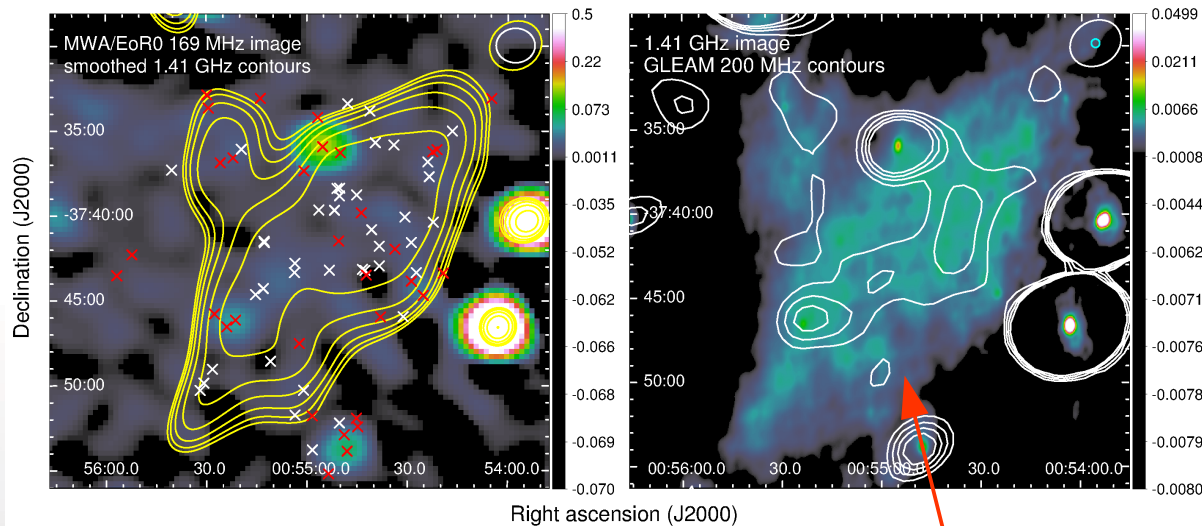
NGC 7793



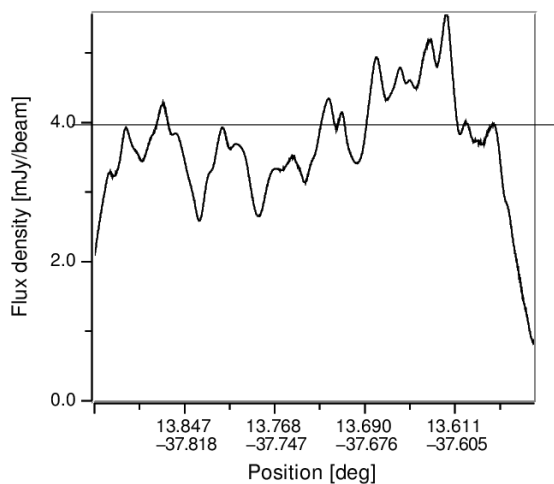
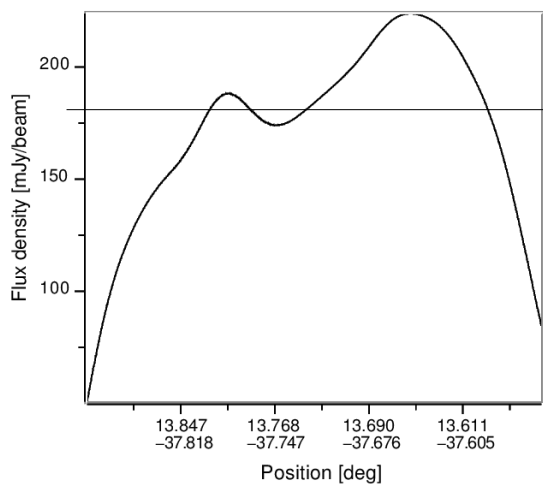


Other detections of Sculptor Group galaxies

NGC 300



Kapinska+ 2017c (*almost finished*)

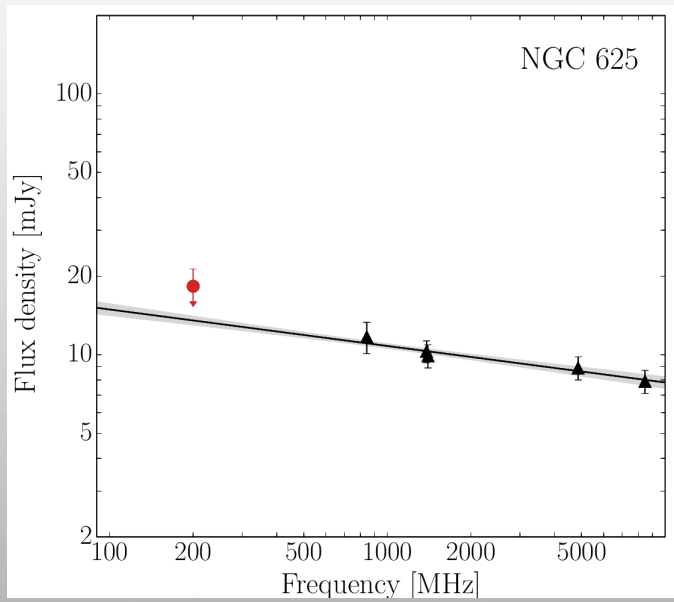
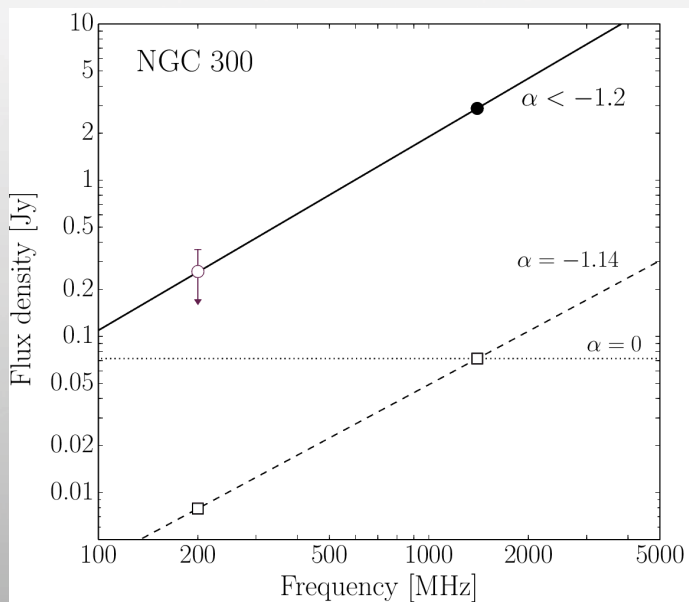
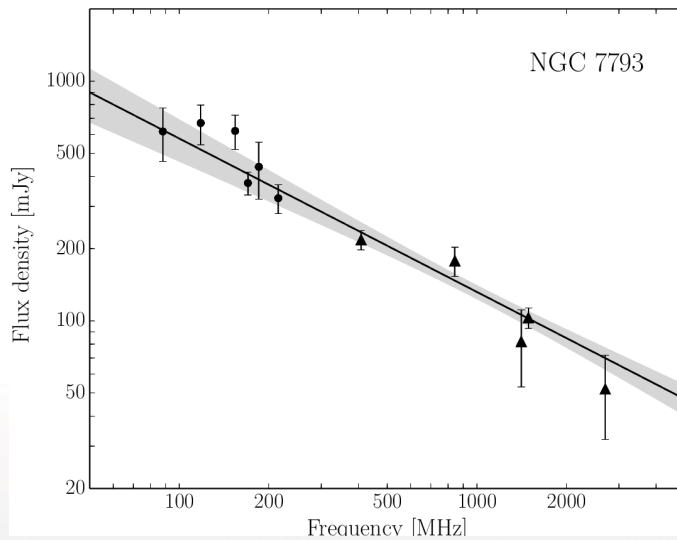
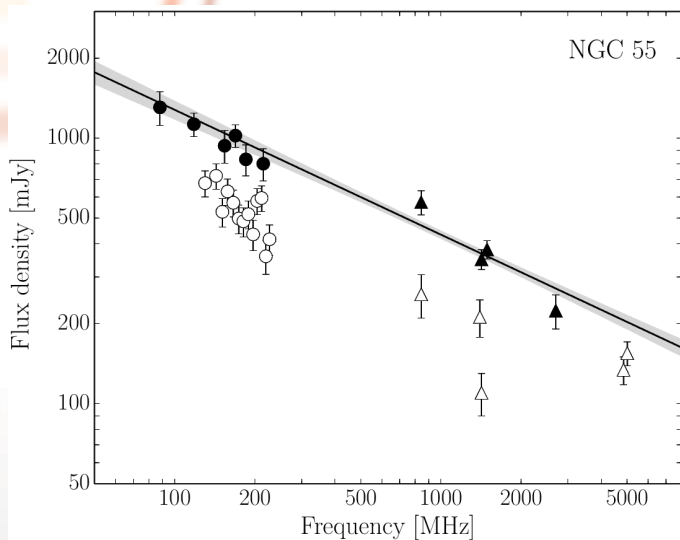


Galvin+ 2014

cf. Condon 1987



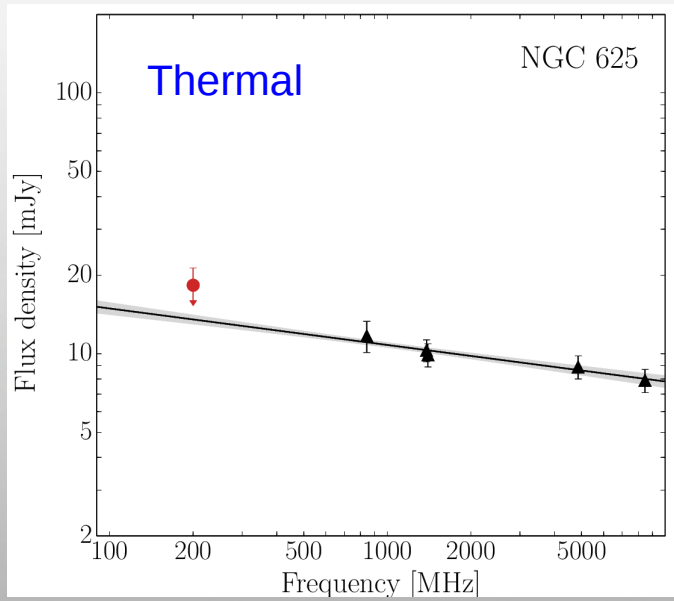
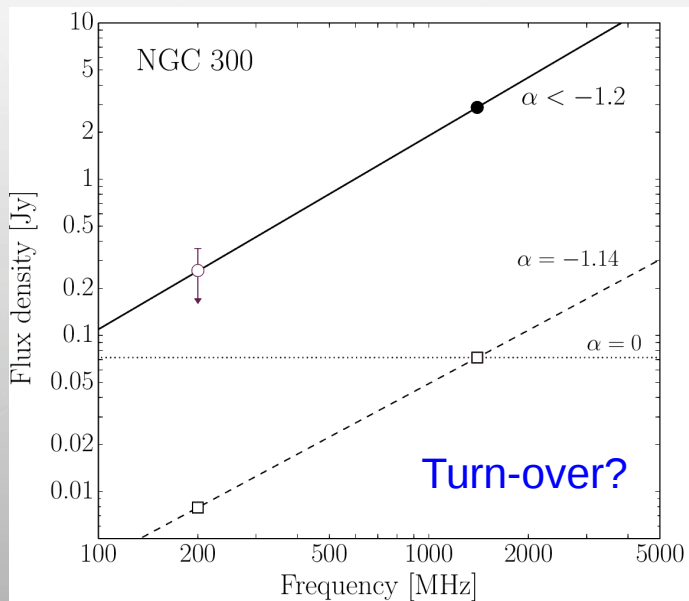
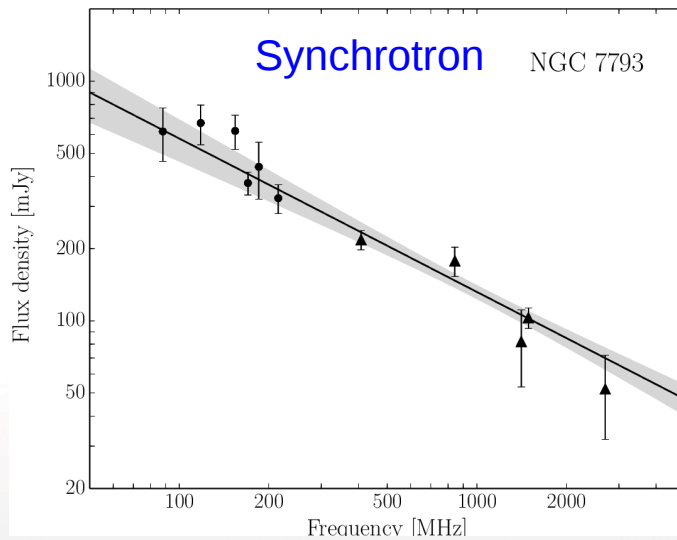
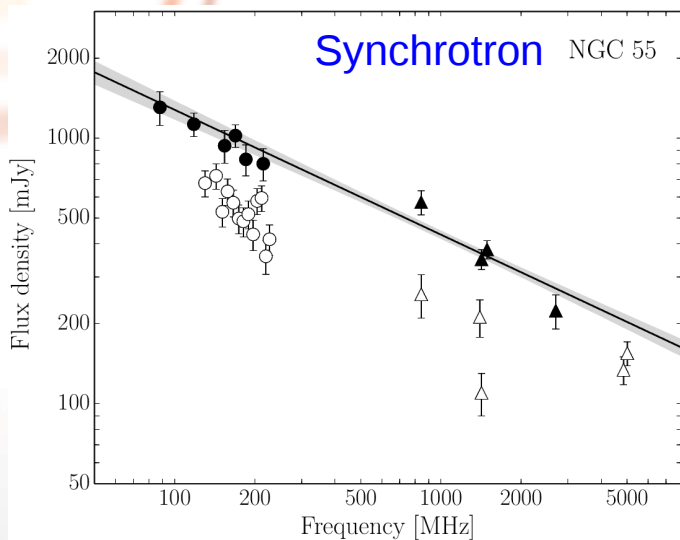
Radio SEDs of Sculptor Group galaxies



Kapinska+ 2017c
to be subm.



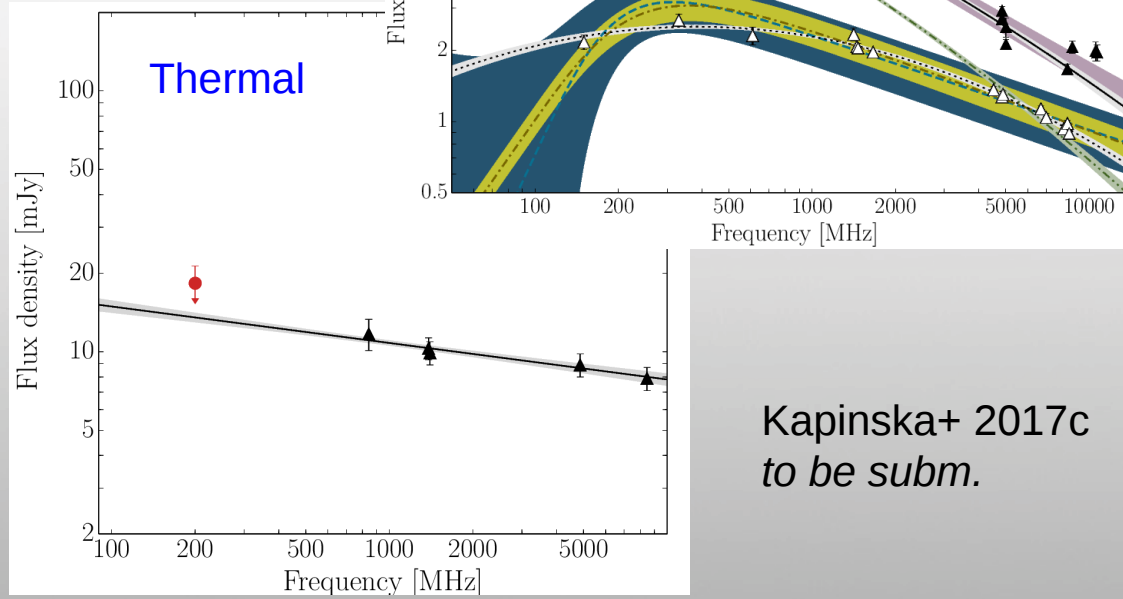
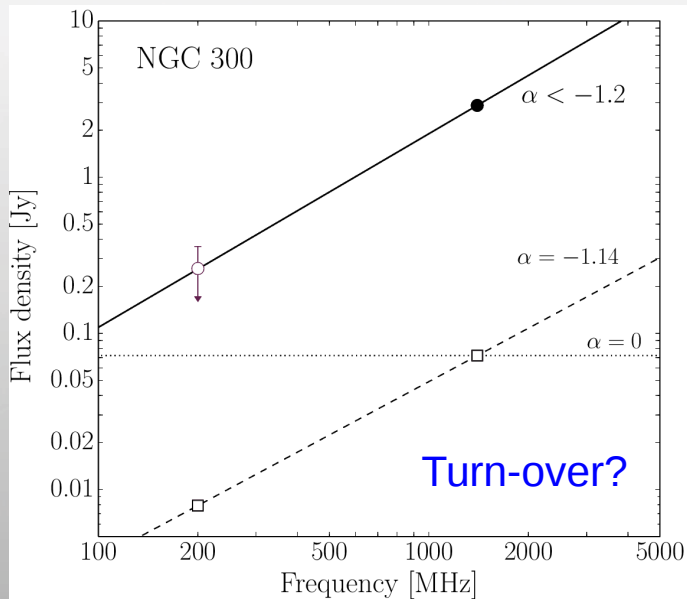
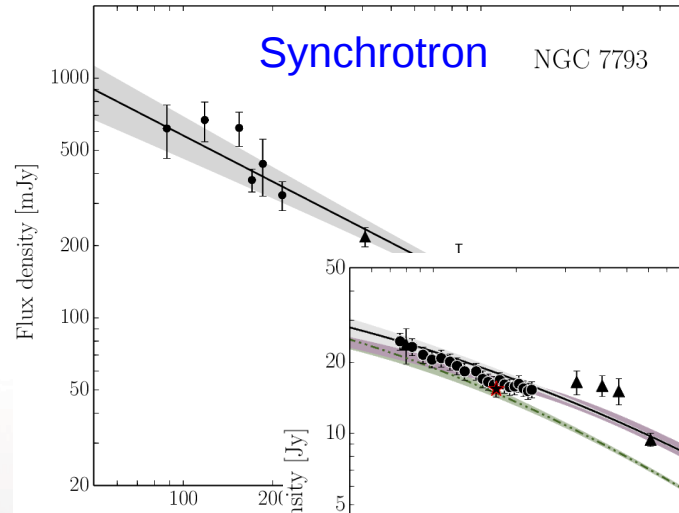
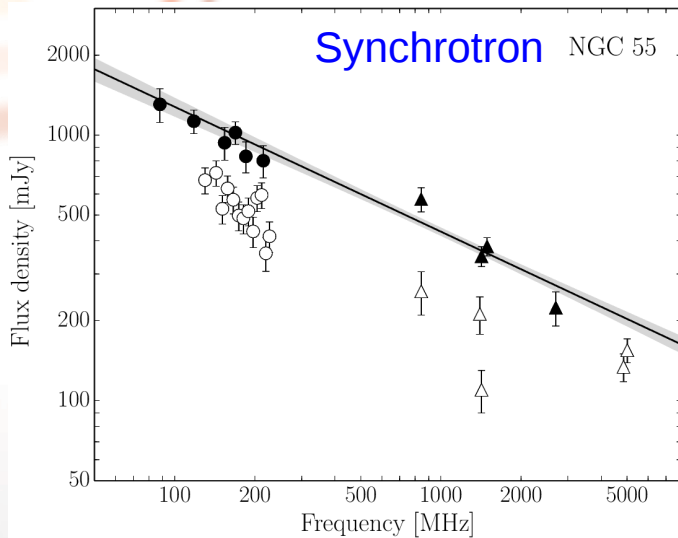
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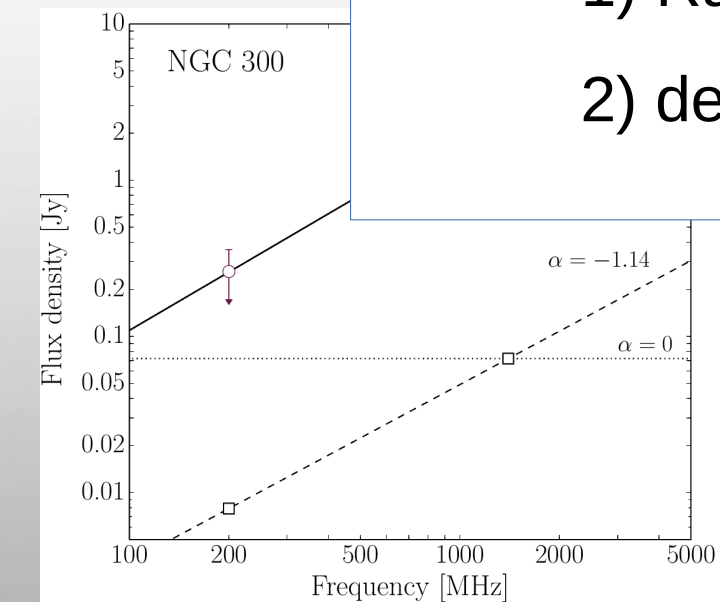
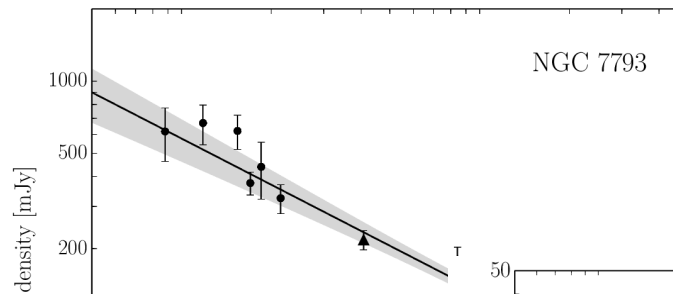
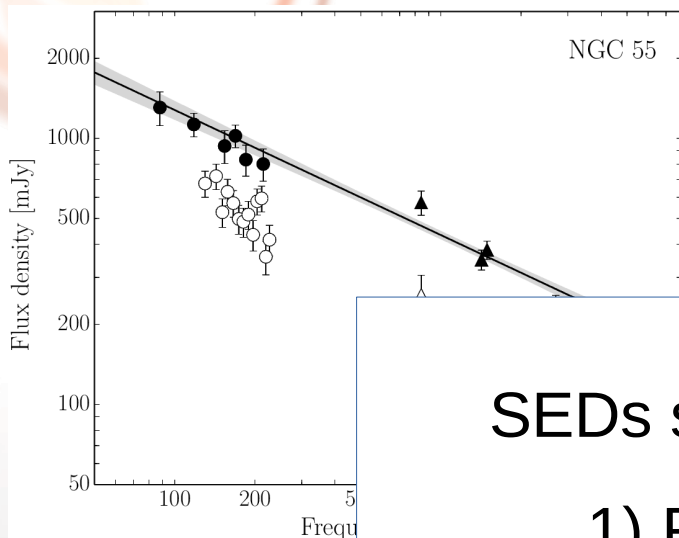
Radio SEDs of Sculptor Group galaxies



Kapinska+ 2017c
to be subm.

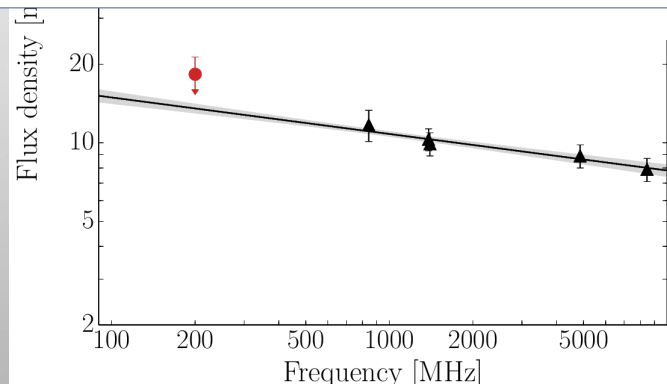
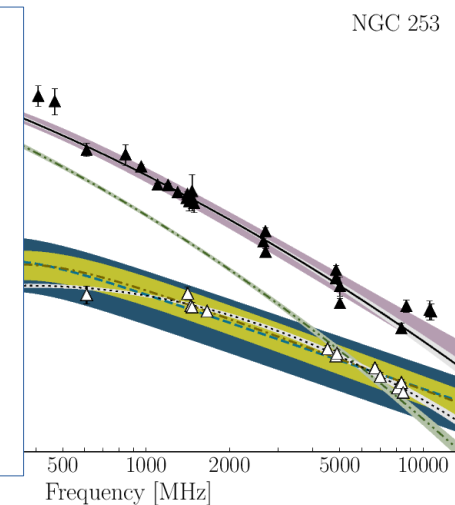


Radio SEDs of Sculptor Group galaxies



SEDs show variety of shapes

- 1) Radio \rightarrow SF tracer..
- 2) detectability @radio

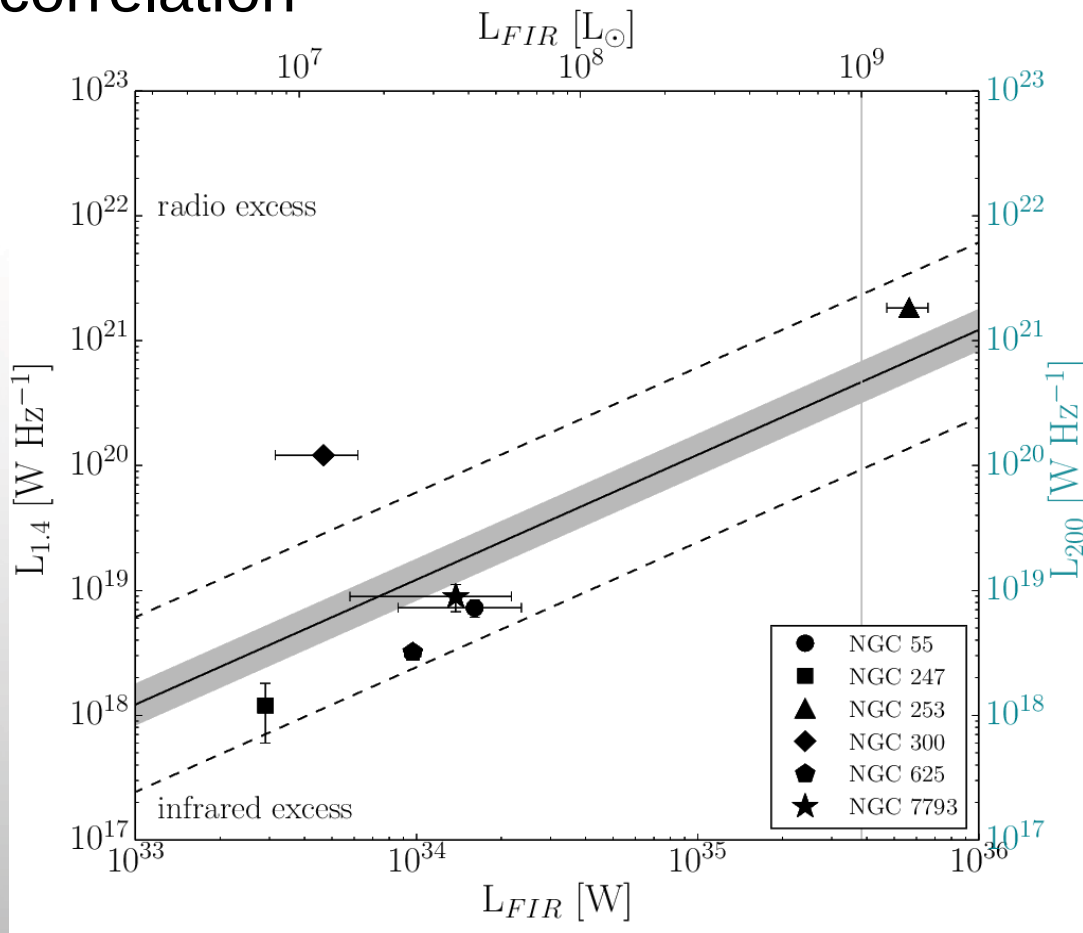


Kapinska+ 2017c
to be subm.



Tracing star formation with radio

FIR/radio correlation



Grey – Yun+ 2001

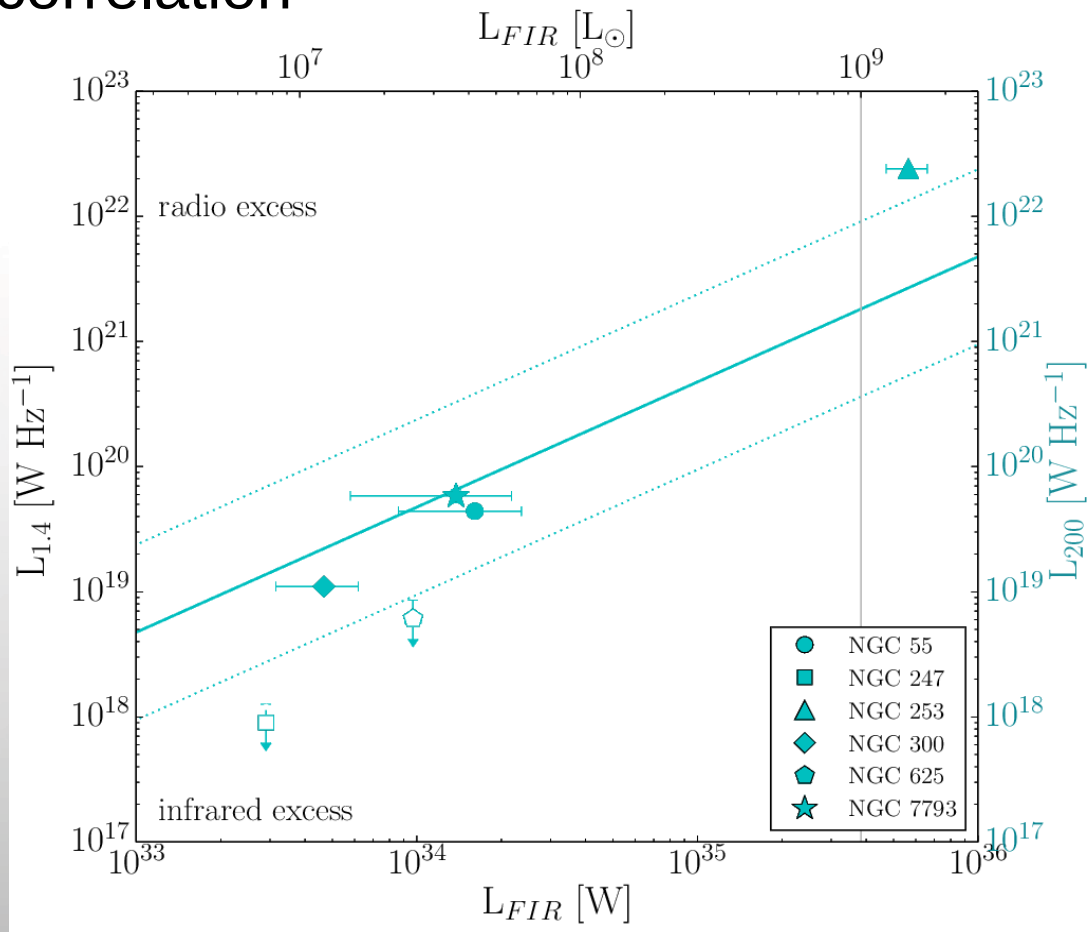
Also for radio-quiet
AGN!! →

Wong+ 2016



Tracing star formation with radio

FIR/radio correlation



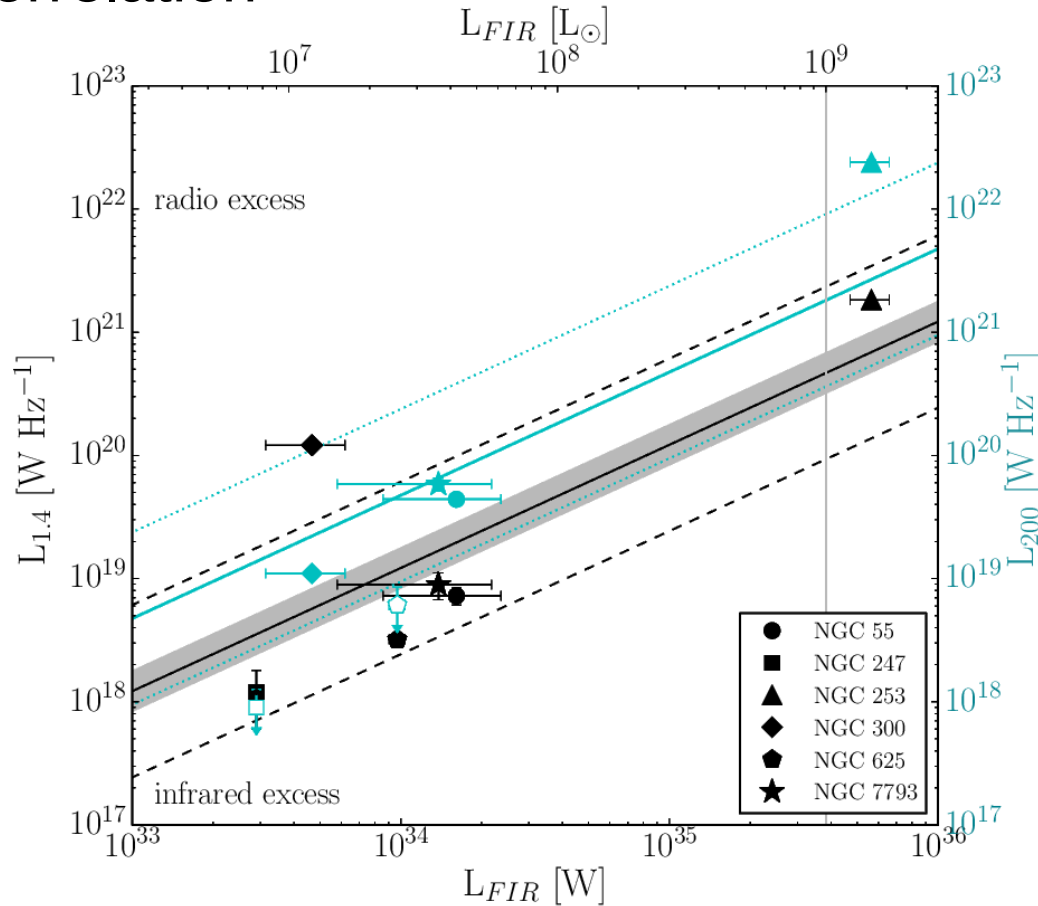
similar: Callistro-Rivera+
2017 (150MHz)

Cyan – scaled



Tracing star formation with radio

FIR/radio correlation



Kapinska+ 2017c to be subm.



Summary

- Star formation @ radio frequencies still poorly understood, need more study of broadband radio SEDs (MHz \leftrightarrow GHz)
- Much more to it than just sum of HII regions and SNRs
- FIR/radio correlation at MHz radio frequencies better than at 1.4GHz?

