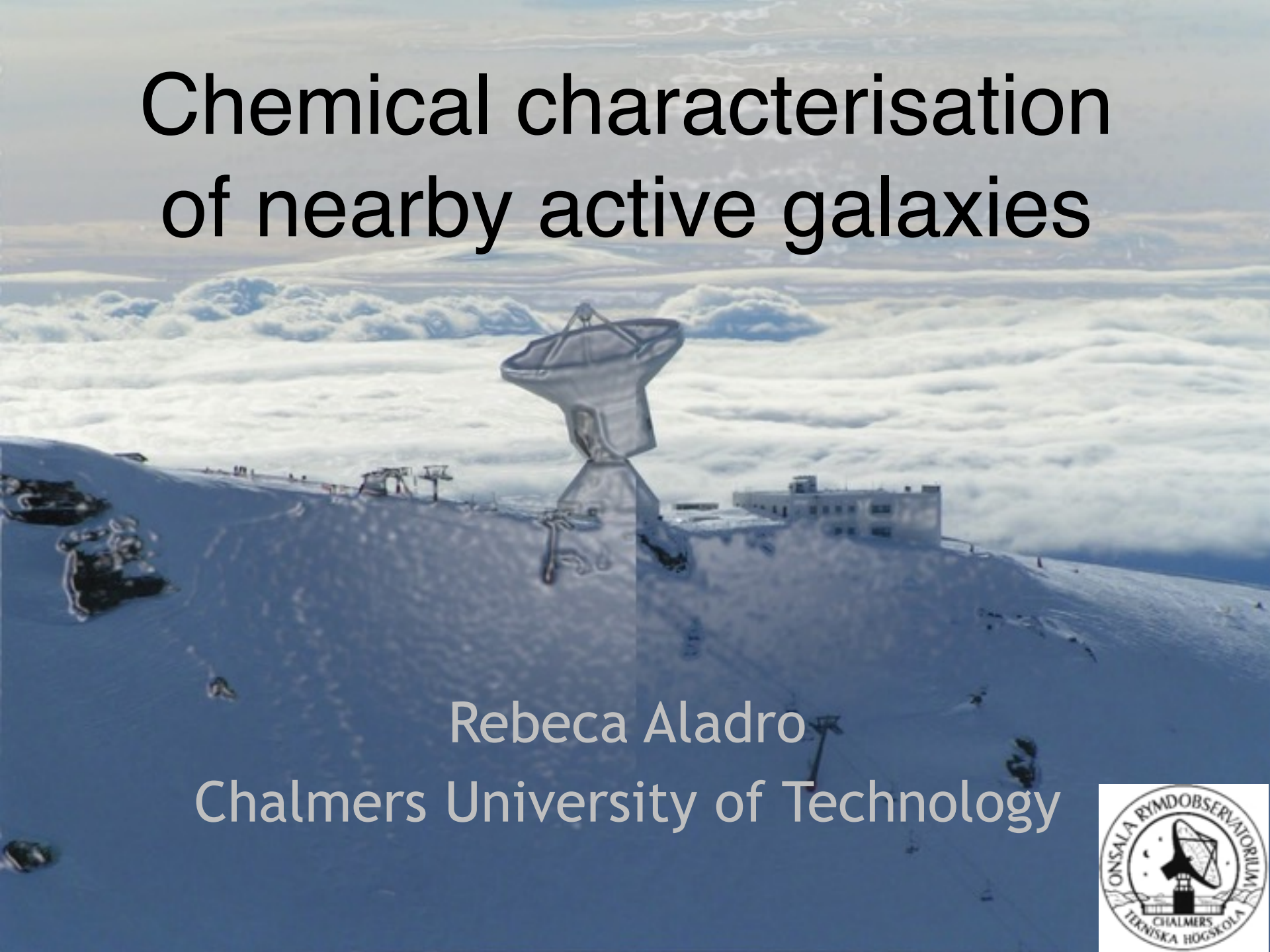
Chemical characterisation of nearby active galaxies



Rebeca Aladro
Chalmers University of Technology

Chemical characterisation of nearby active galaxies

Warning: this talk doesn´t contain deuterium fractionation!!

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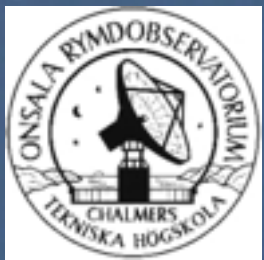
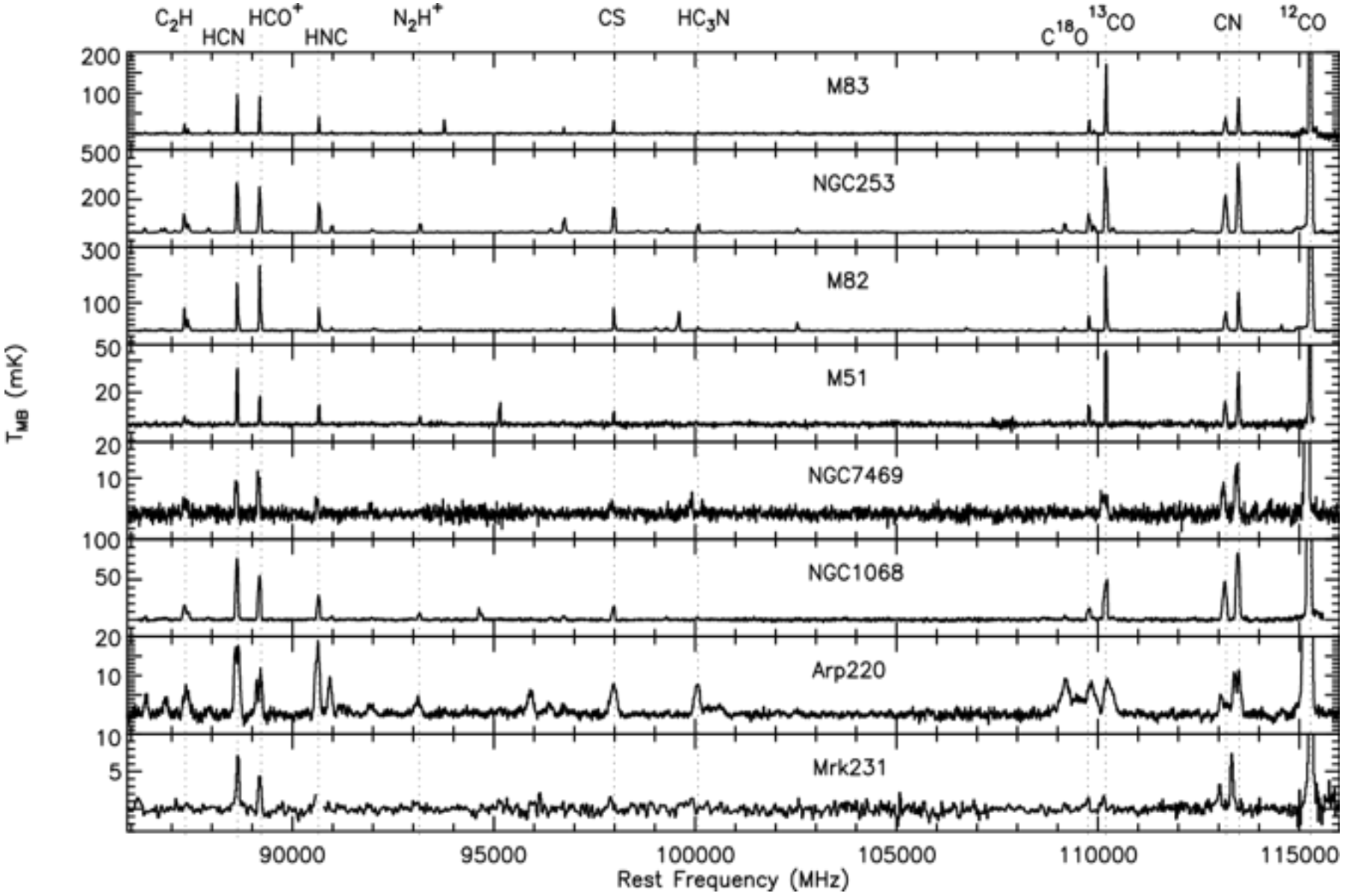
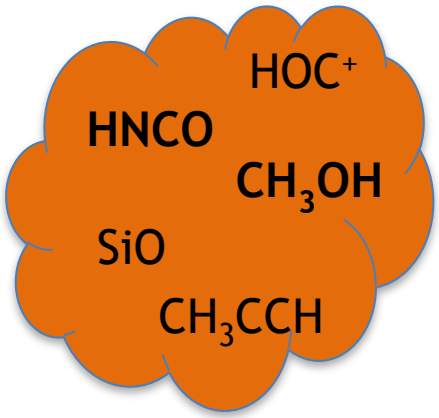


3mm survey of eight nearby active galaxies



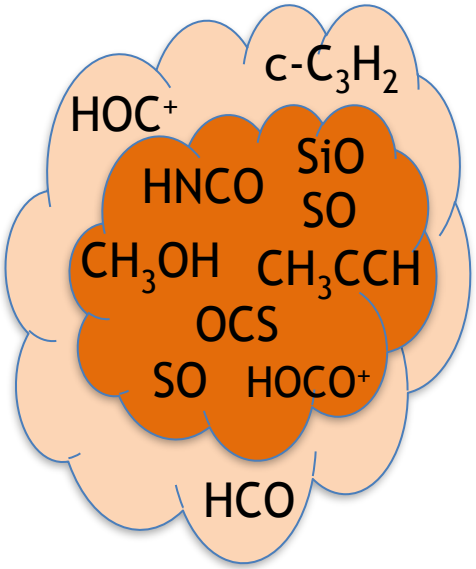
Chemical Evolution of Local Starburst Galaxies

Young
(M83, Maffei2)



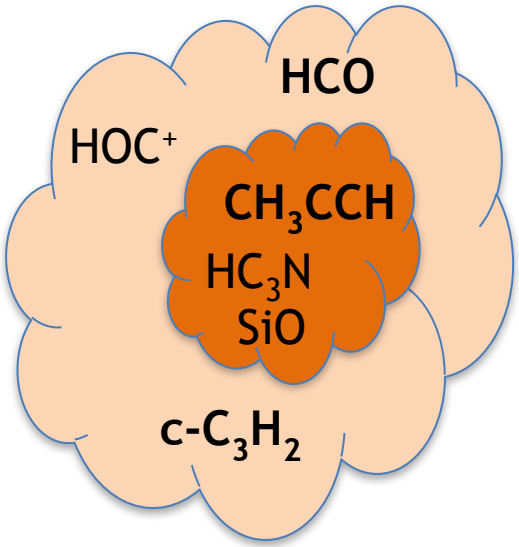
- Common shock/grain- and dense gas tracers
- Only HOC+ as PDR tracer
- No Hα recombination lines

Intermediate
(NGC253, IC342)



- Shock/grain- and dense gas tracers (including "rare" species)
- PDR tracers
- Bright Hα recombination lines

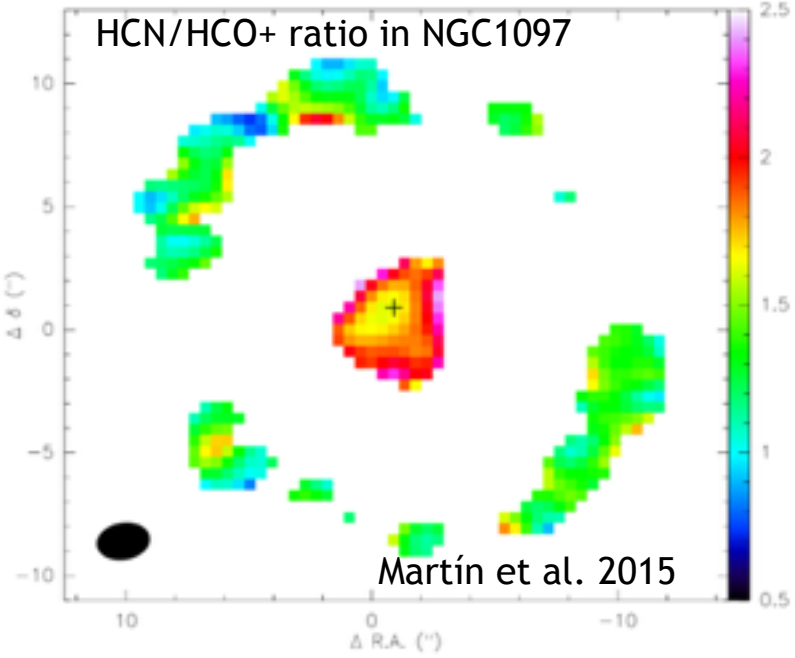
Old
(M82)

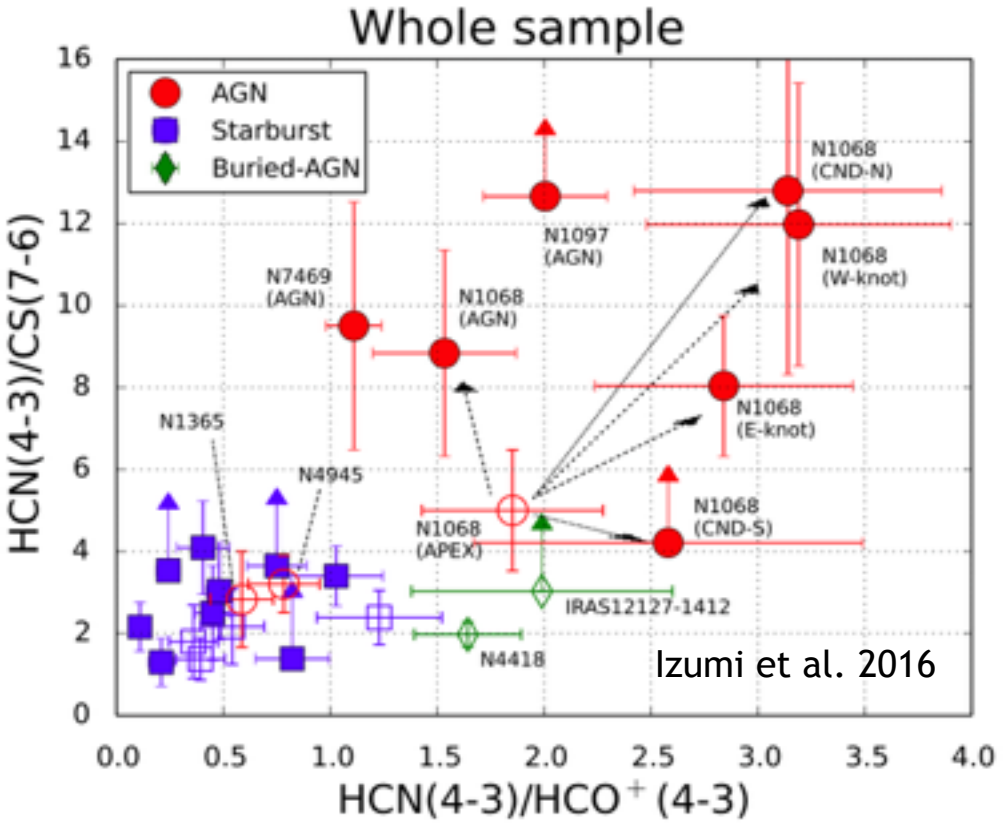


- PDR tracers
- Some shock/grain- and dense gas tracers
- Very bright Hα recombination lines

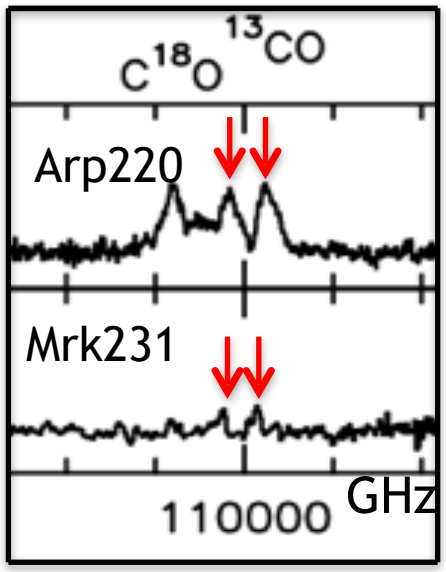
Higher resolution is needed to study AGNs

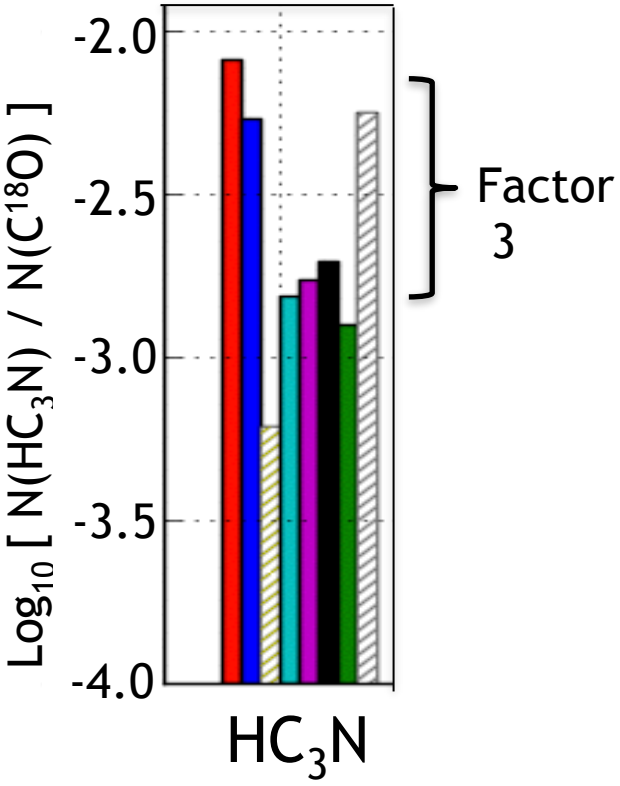
Single dish: HCN/$C^{18}O$, HNC/$C^{18}O$, CN/$C^{18}O$, $C_2H/C^{18}O$, HCO^+/HCN, CN/HCN:
Do not correlate with AGN activity:
mixing of SB and AGN emissions

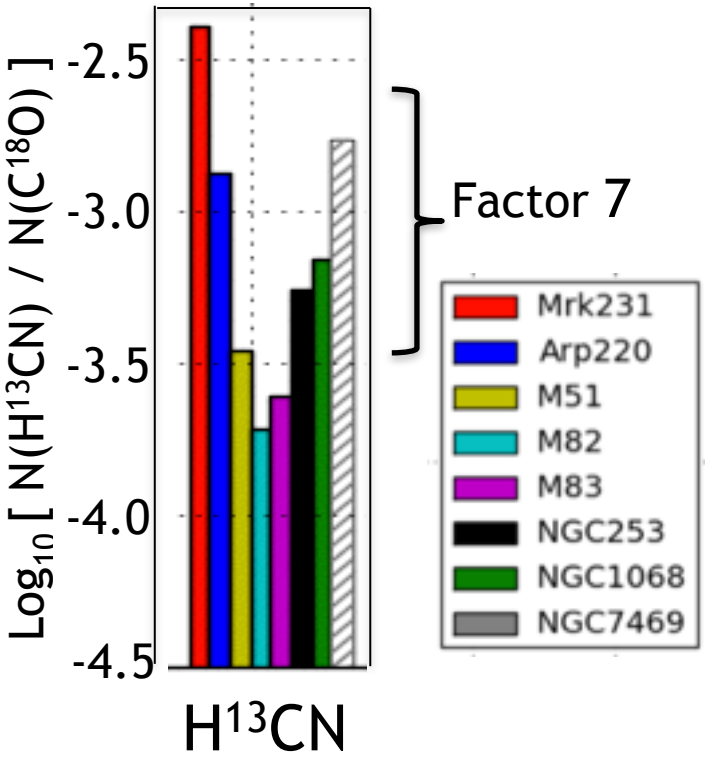




ULIRGs are characterised by high abundances of ^{18}O, HC_3N and $H^{13}CN$



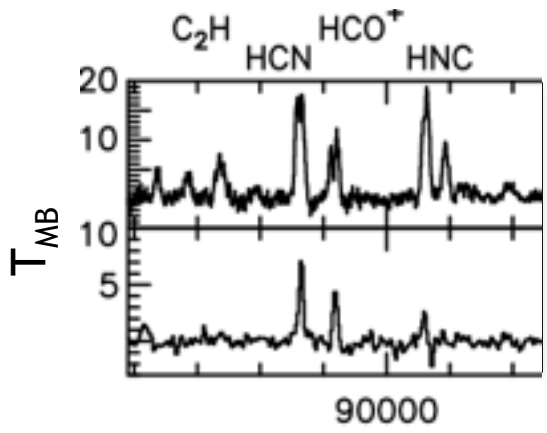




Less diffuse and more enriched gas in ULIRGs: nucleosynthesis along time

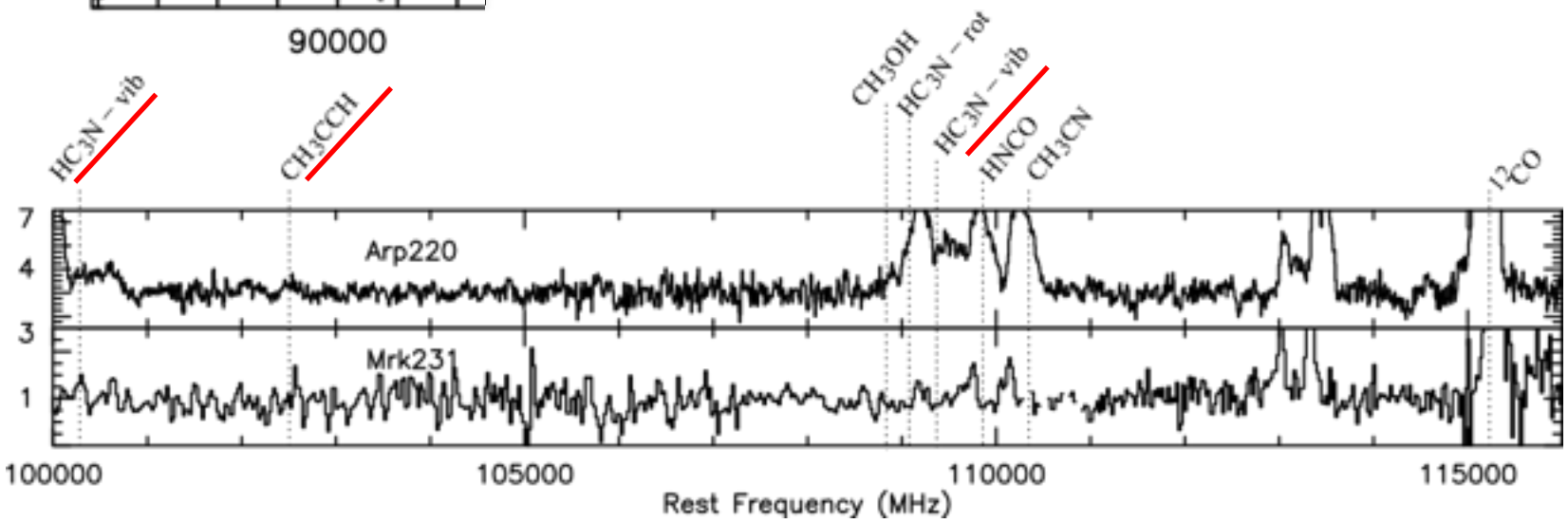
More warm dust in ULIRGs allows high abundances of these species

Differences between Arp220 and Mrk231 point to different nuclear powering sources



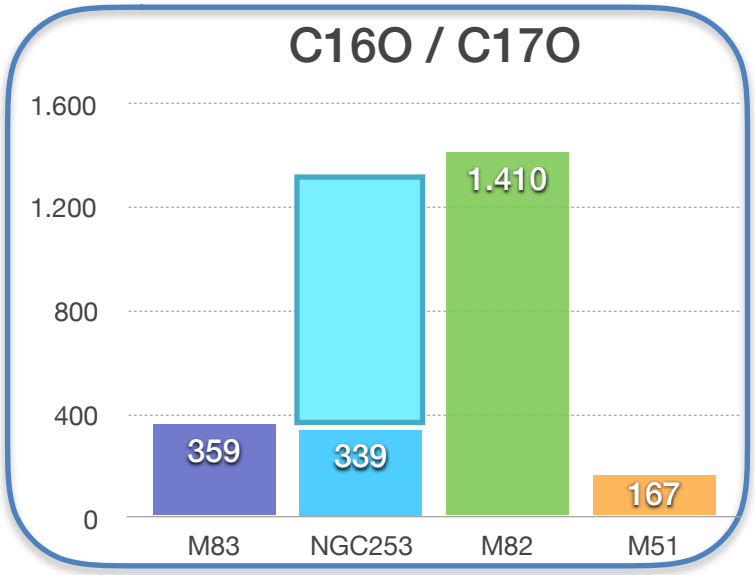
Arp220: HNC > HCN ⟶ High HNC { mid-IR pumping / XDRs

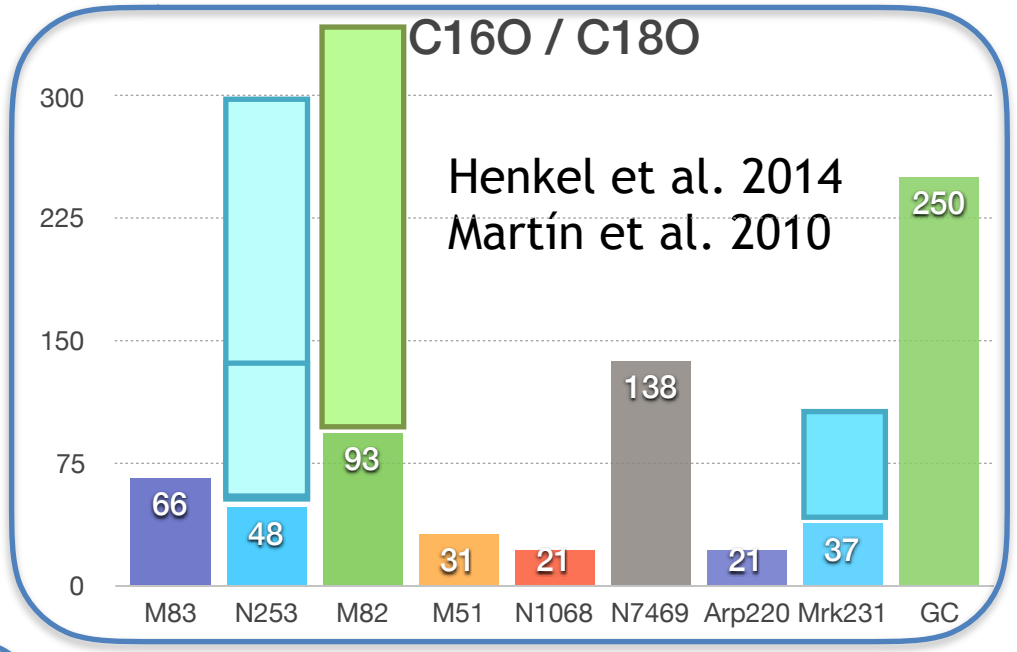
Mrk231: HNC < HCN

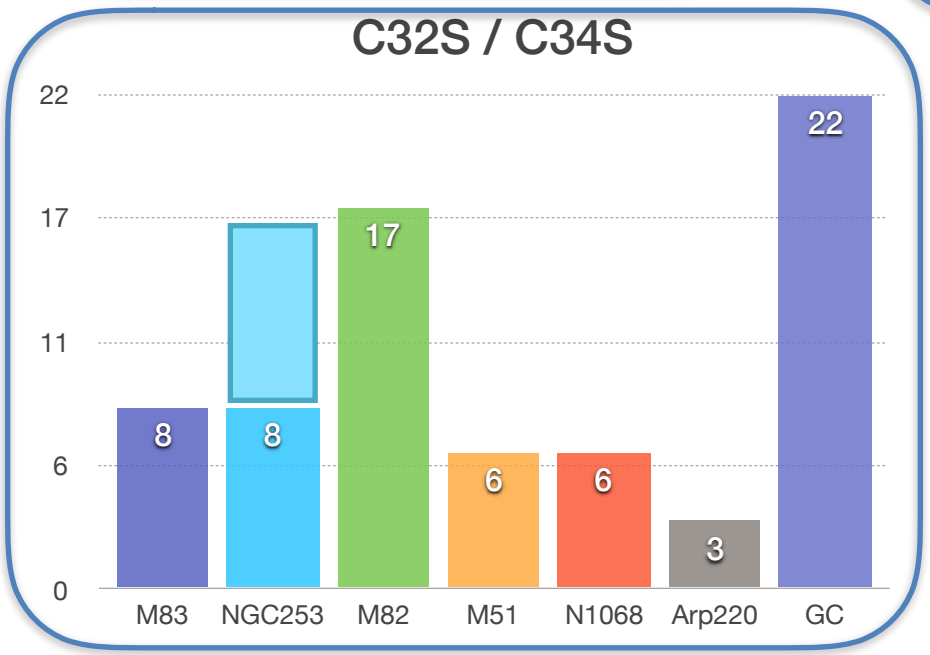


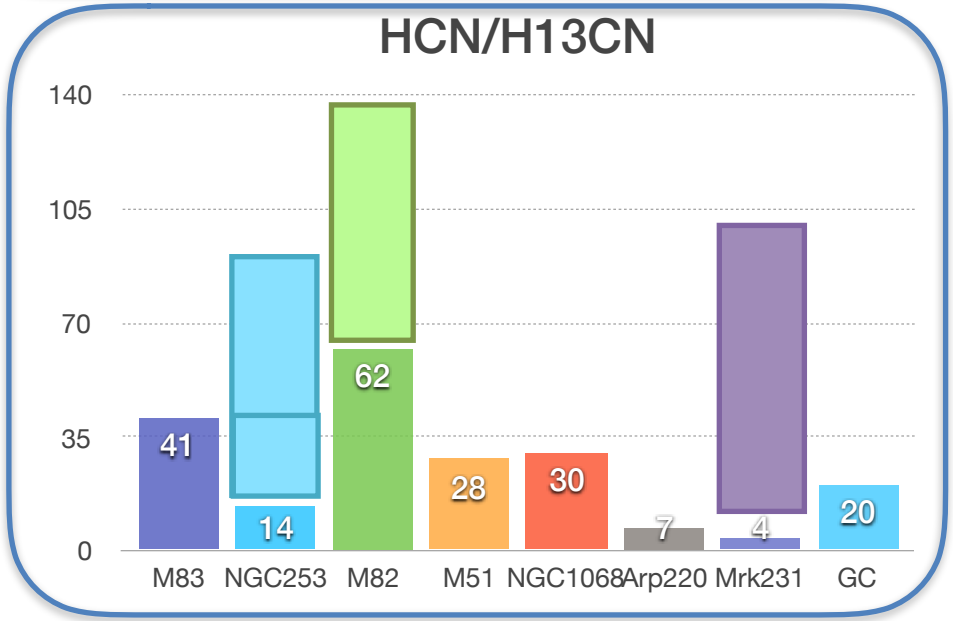
Arp220: HC_3N vibrationally excited T_{vib}=190 ± 20 K. Massive star-forming regions

Extragalactic Isotopic Ratios (OMG!)

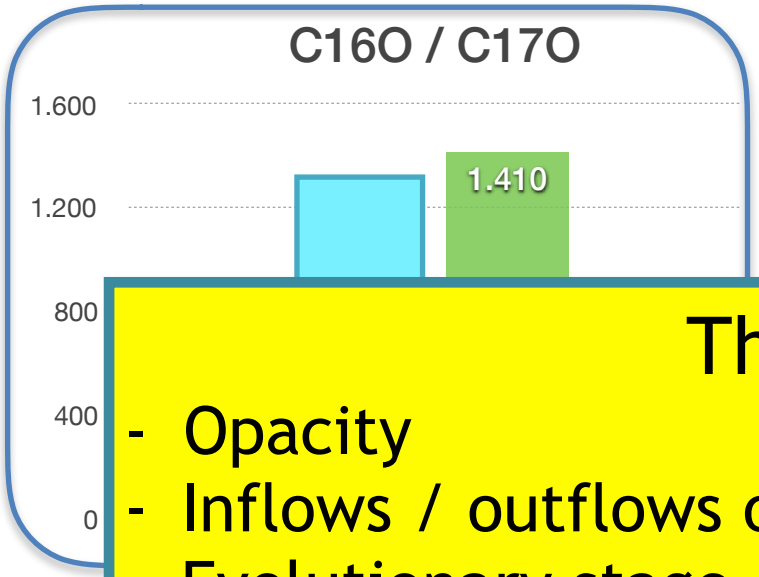


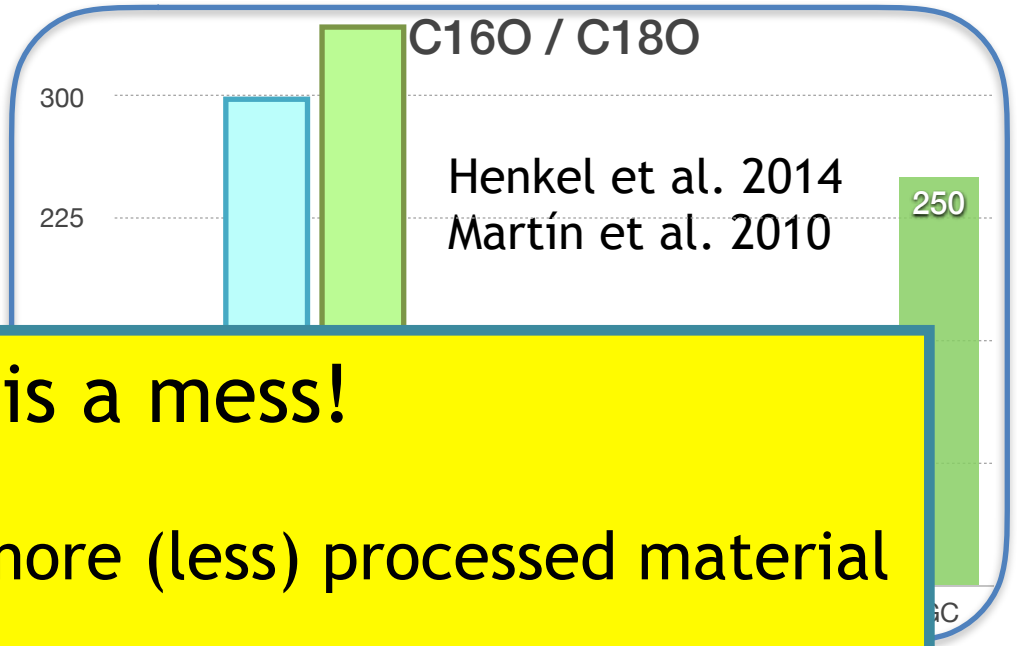






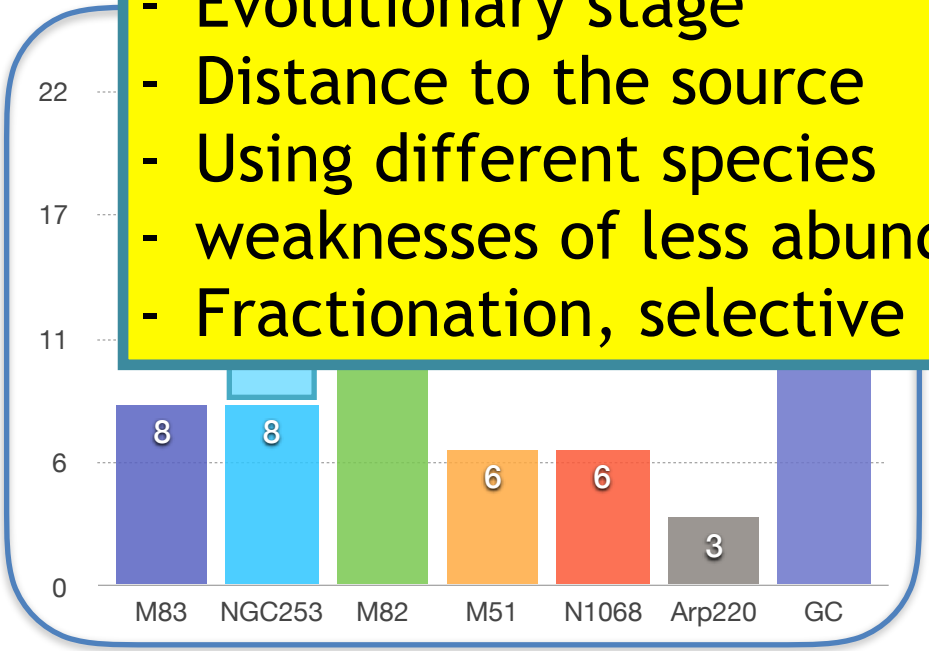
Extragalactic Isotopic Ratios (OMG!)

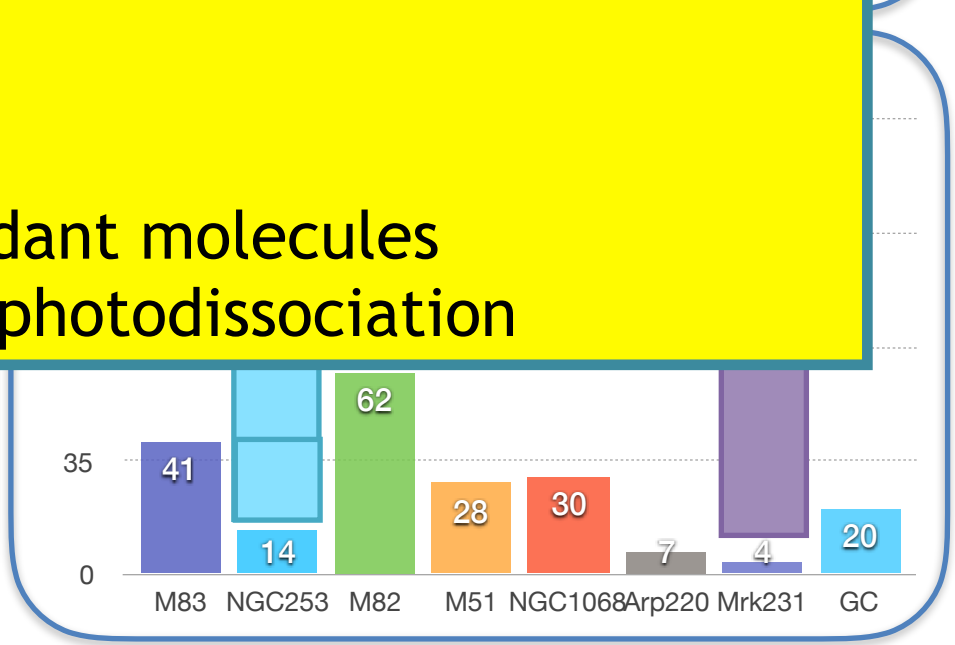




This is a mess!

- Opacity
- Inflows / outflows of more (less) processed material
- Evolutionary stage
- Distance to the source
- Using different species
- weaknesses of less abundant molecules
- Fractionation, selective photodissociation





Summary

- Shocks and UV fields vary with starburst evolution and shape starbursts galaxies chemistry: HNCO, CH_3OH, CH_3CCH, c-C_3H_2….
- ULIRGs are chemically characterised by high $C^{18}O$, HC_3N and $H^{13}CN$ abundances and vibrationally excited HC_3N (HCN, HNC). Arp220: starburst, Mrk231: AGN.
- Need of multi-line analysis to avoid excitation effects, also need of high resolution to study AGNs
- What is the best method to calculate isotopic ratios and compare among galaxies?