Coronal emission from radio-quiet AGNs at high redshift

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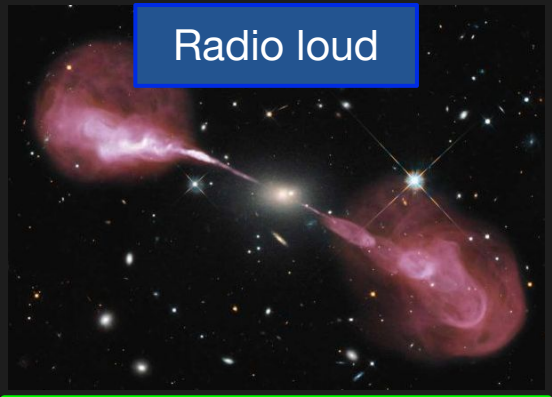


AGNs

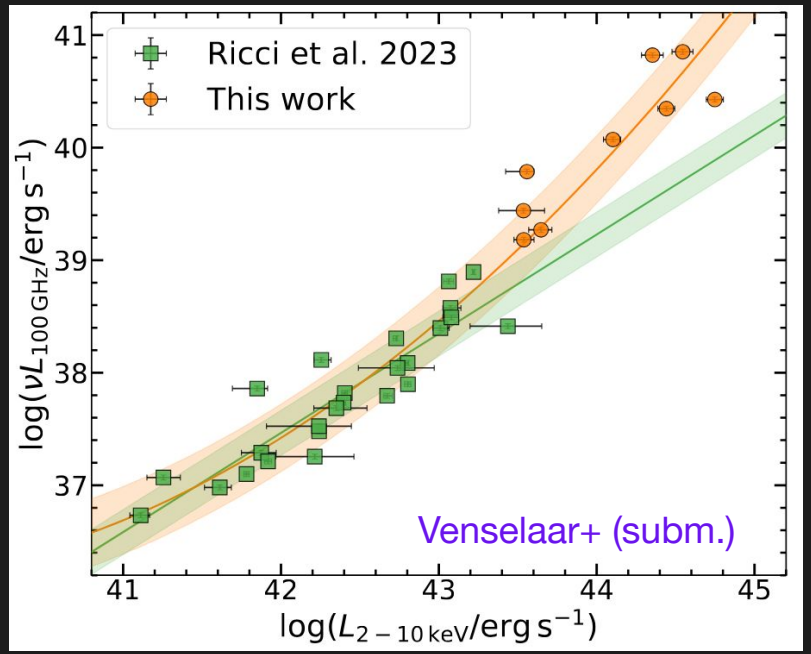
- ~90% of all AGN are radio-quiet

The **corona** is:

- A very compact (5-100 r_g) and extremely hot (~10^9 K) plasma close to the supermassive black hole.
- Responsible for the hard X-ray emission observed.
- Likely heated by magnetic reconnection → Also leads to relativistic (non-thermal) particle acceleration

Key results in local galaxies (z<0.1)

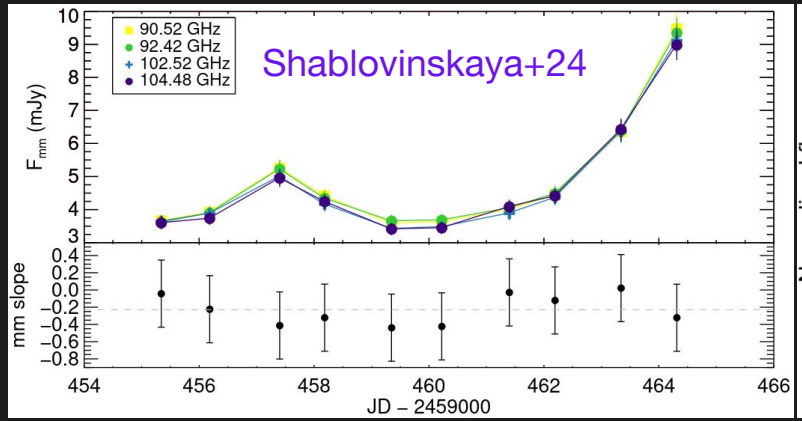
1. Correlations found between L_{mm} and L_X in local galaxies (z<0.1)

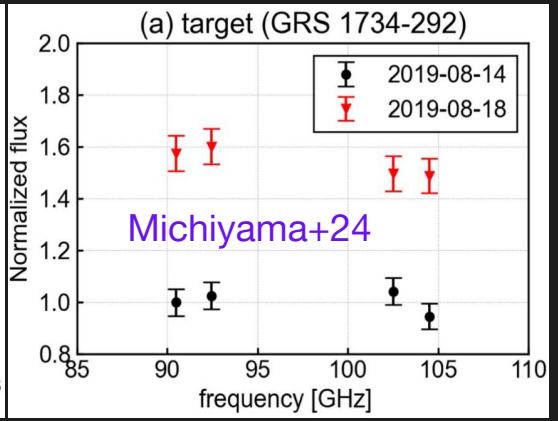


Important application to obscured galaxies in which X-rays cannot escape!

Key results in local galaxies (z<0.1)

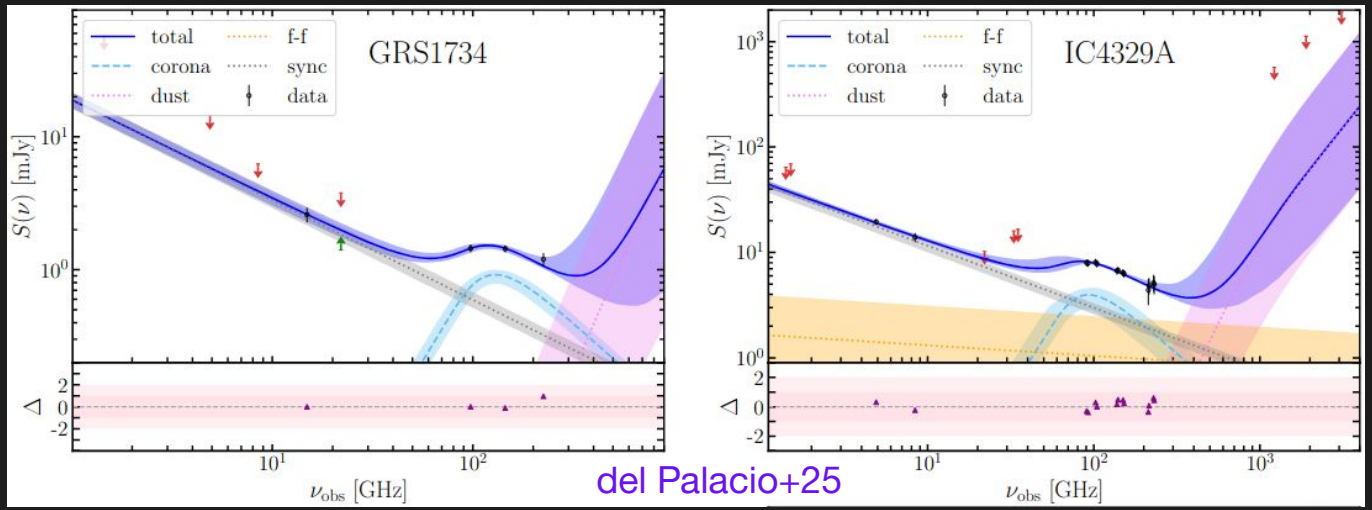
1. Correlations found between L_{mm} and L_X
2. Variability of the mm emission on ~daily timescales





Key results in local galaxies (z<0.1)

1. Correlations found between L_{mm} and L_X
2. Variability of the mm emission on ~daily timescales
3. A *bump* in the SED at ~100 GHz



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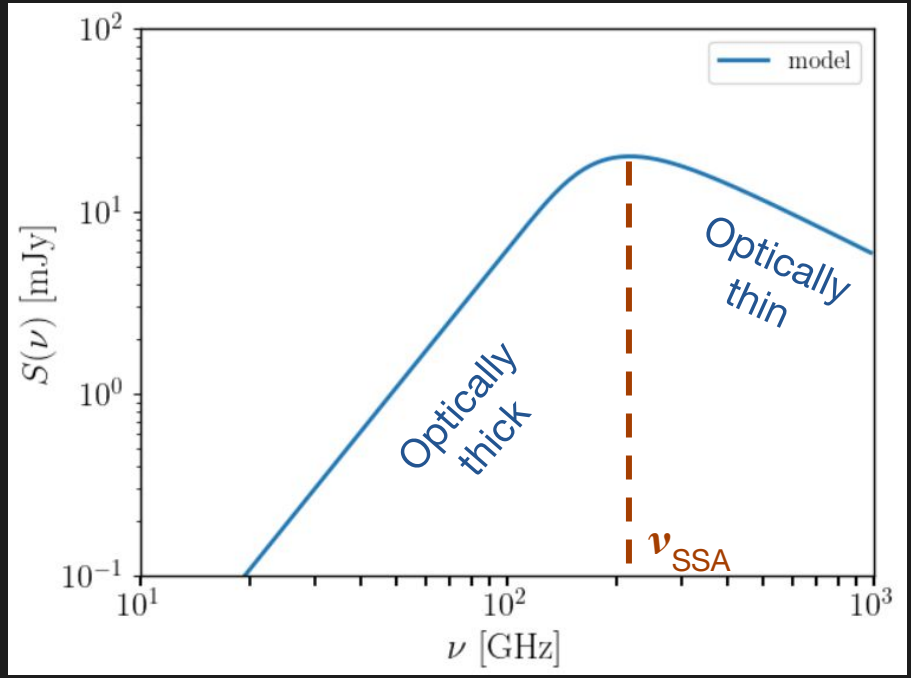
Corona emission model

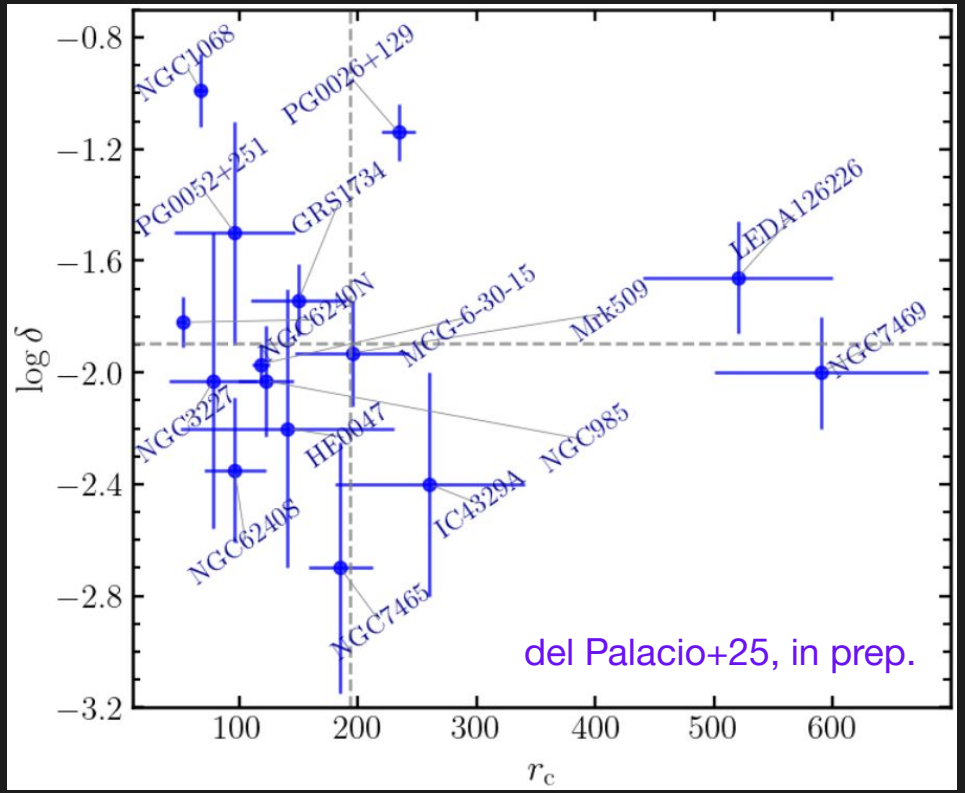
- Homogeneous spherical corona of radius $R_{\rm c} = r_{\rm c}\, R_{\rm g}$
- A fraction δ of the energy goes into non-thermal (ultrarelativistic) electrons
- Energy condition for the magnetic field intensity: $u_B = \eta_B\, u_{\rm nt}$



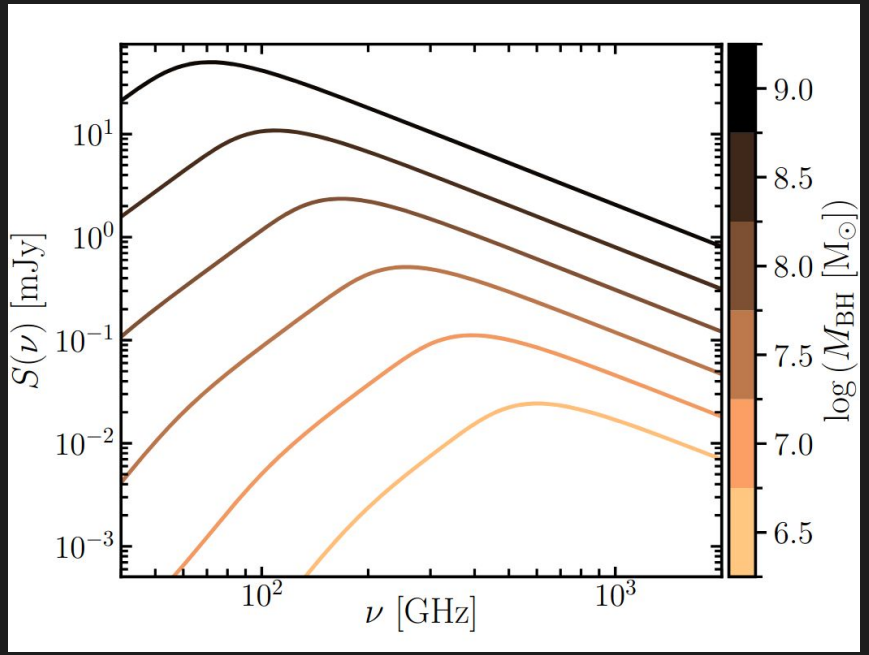
Corona emission model

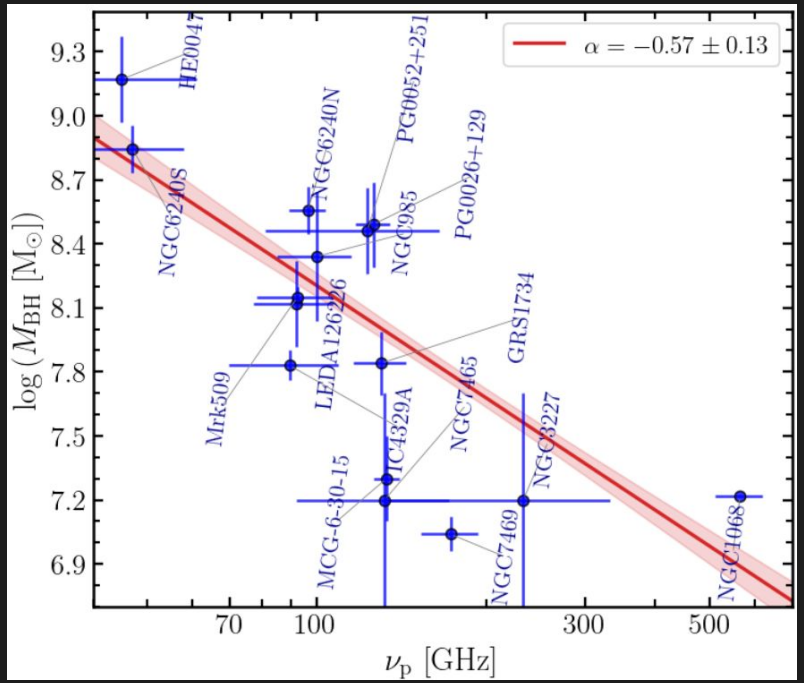
***Typical* parameters:**

- r_c ~ 200
- U_{nt}/U_{th} ~ 1%
- B ~ 25 G



SED dependence on M_{BH}



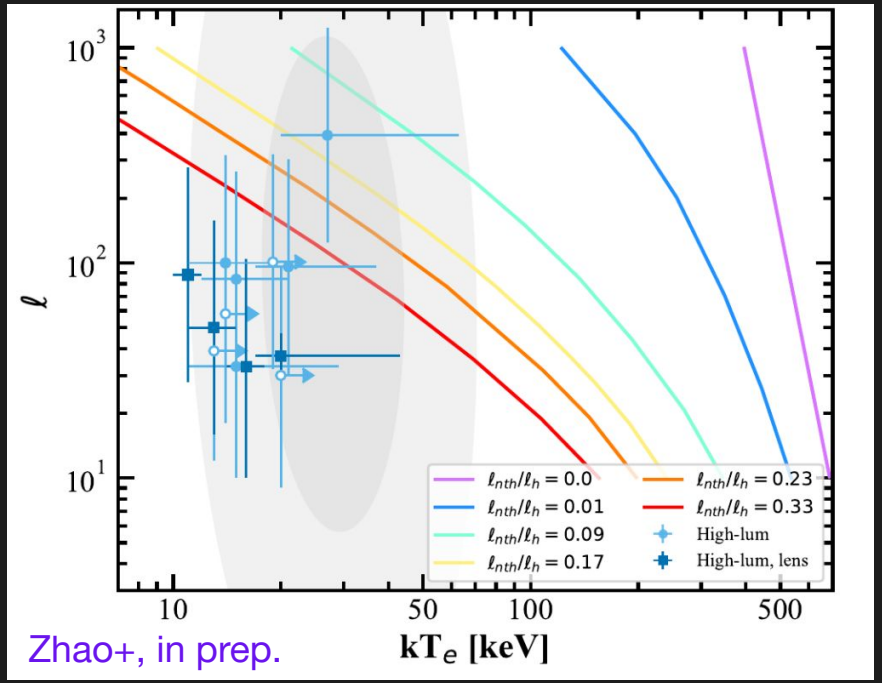


A possible way to estimate M_{BH} ?

del Palacio+25, in prep.

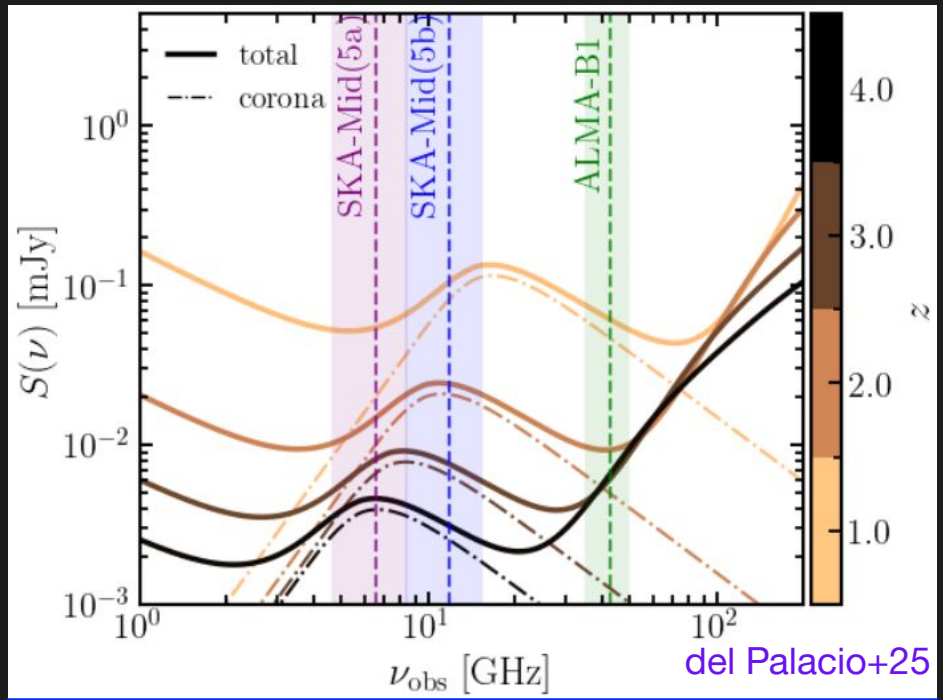
Extra Motivation

- Predicted dependence on corona compactness, temperature and non-thermal fraction
- *kT* can be measured in some high-*z* AGN



Studies at high redshift

$M_{\rm BH} = 10^9 M_\odot$



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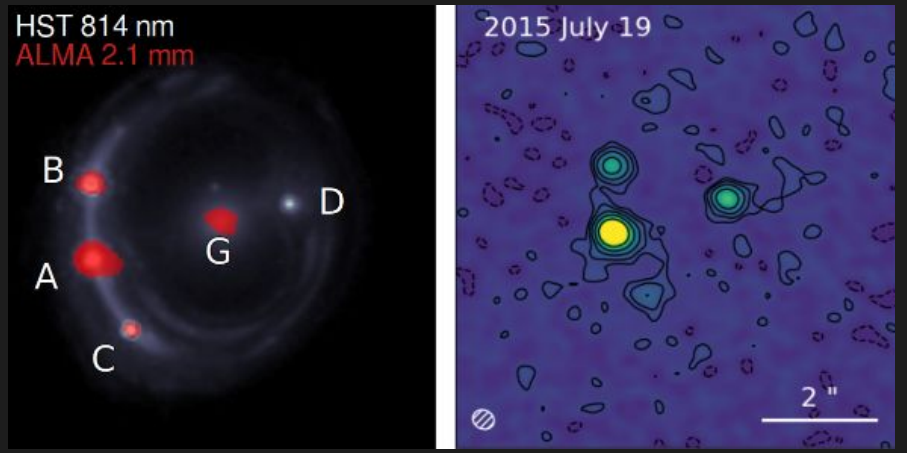
Possibility to detect lensed sources at high z

Microlensing event revealed the corona in a lensed quasar at z=0.66



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Conclusions

SKA can be key in the study of radio-quiet AGNs to determine:

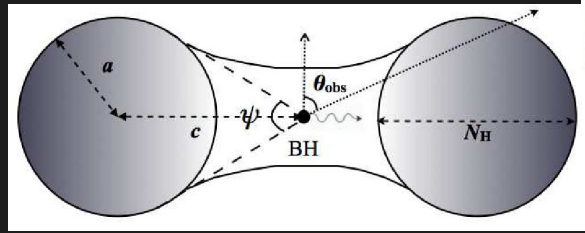
- Properties of the corona (size and non-thermal fraction)
- Intrinsic AGN luminosity (important for obscured sources!)

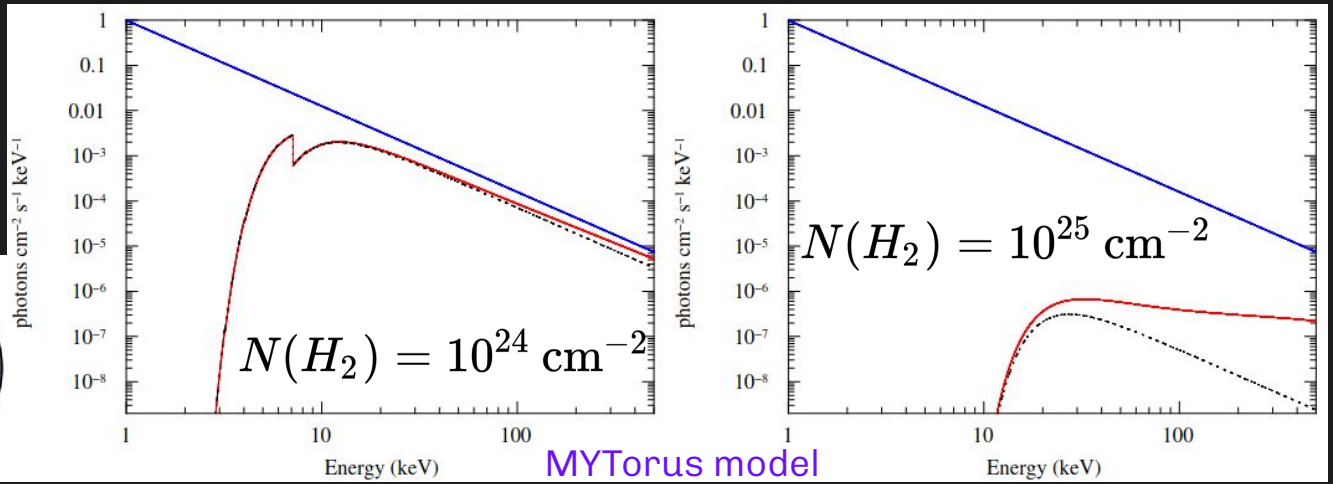
Ideal targets are lensed sources with very massive SMBHs

Extra slides

Obscured galaxies

- Extreme column densities: $N(H_2) > 10^{25}\ \mathrm{cm}^{-2}$ → X-rays cannot escape





Parameter exploration

We aim to minimize the number of free parameters and explore how they affect the SED

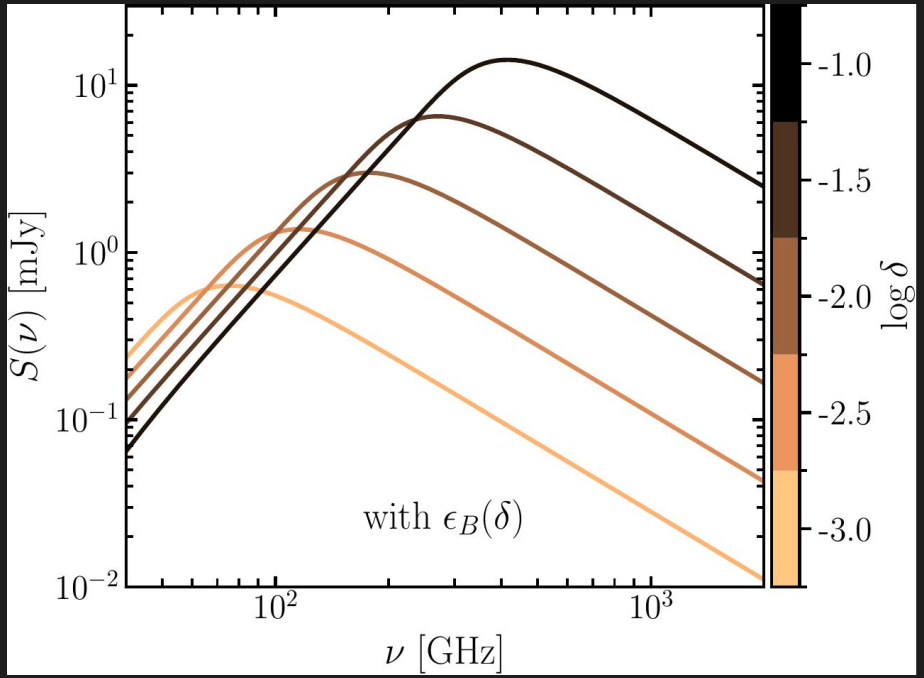
$$\delta = u_{\mathrm{nt,e}} / u_{\mathrm{e}}$$

$$\epsilon_B = u_B / u_{\mathrm{e}}$$

Assume an energy condition

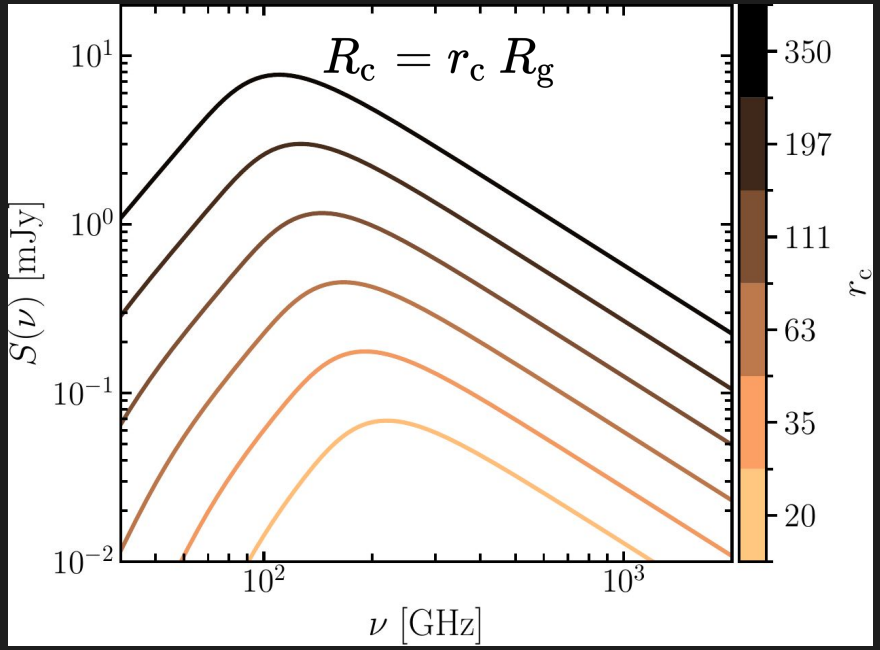
$$u_B = \eta_B \, u_{\mathrm{nt}}$$

$$\epsilon_B(\delta) = \eta_B \, \delta \, (1 + \xi_{\mathrm{e,p}}) \approx 30 \, \delta$$

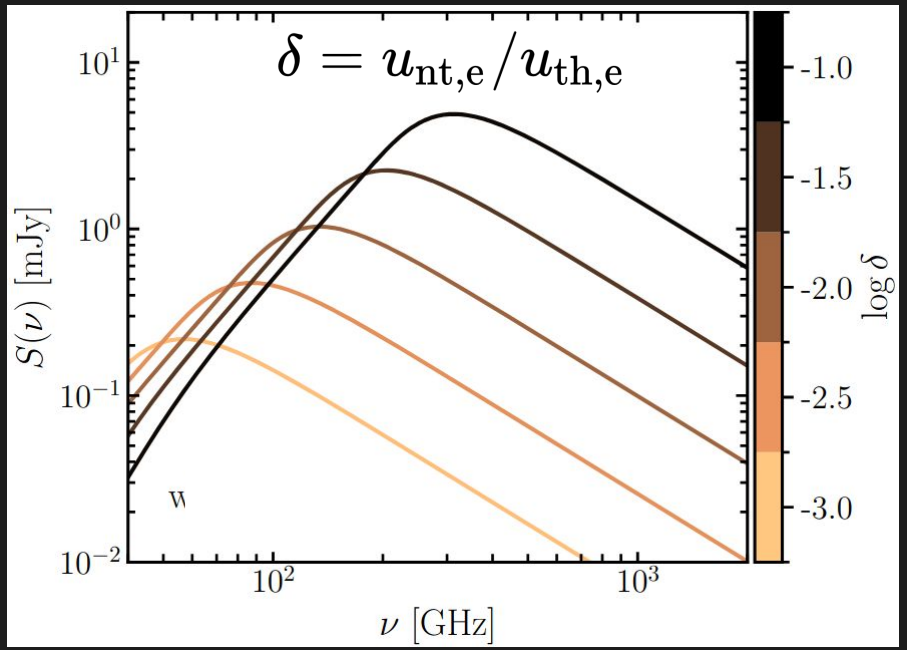


Free parameters

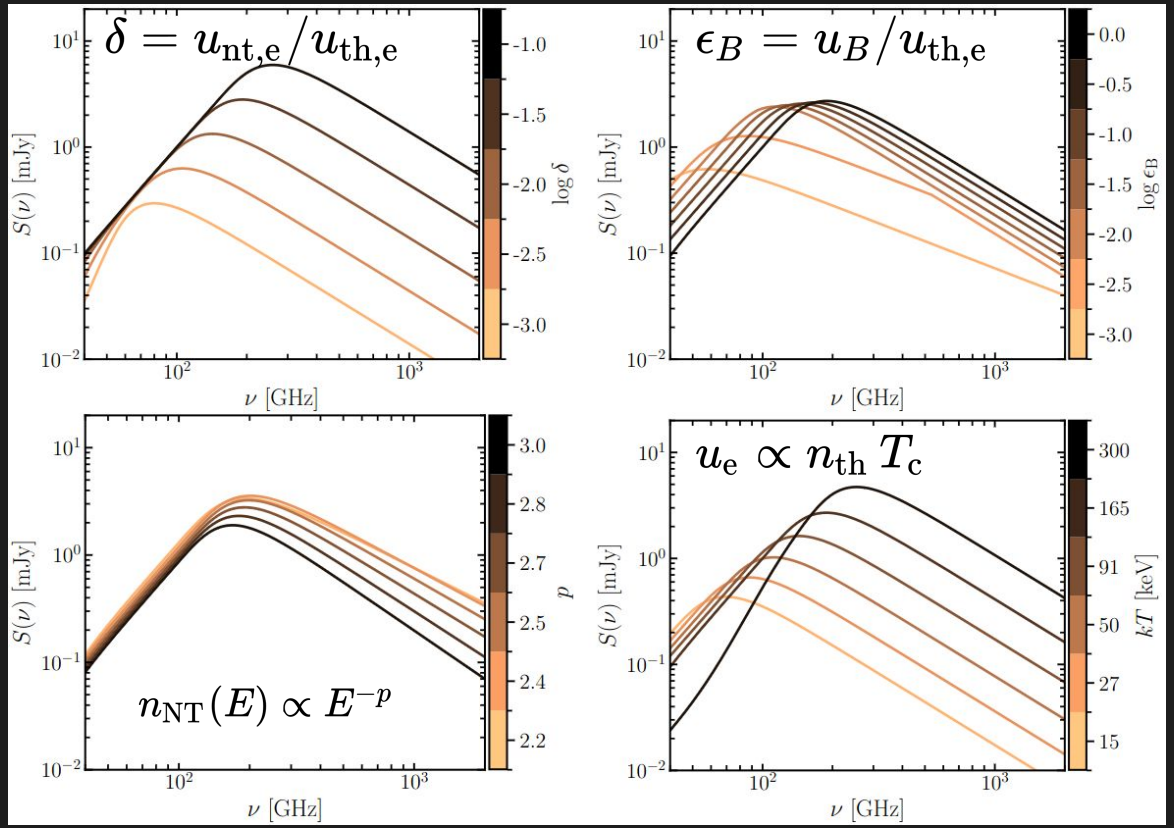
Corona size



Fraction of energy in non-thermal e-



Parameter exploration



Higher flux, higher peak frequency. Too many parameters!