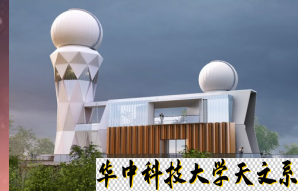

Physical mechanisms for Changing-look AGNs

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2023/12 ShangHai

Outline

1) Introduction

2) CLAGN observations and physical mechanism

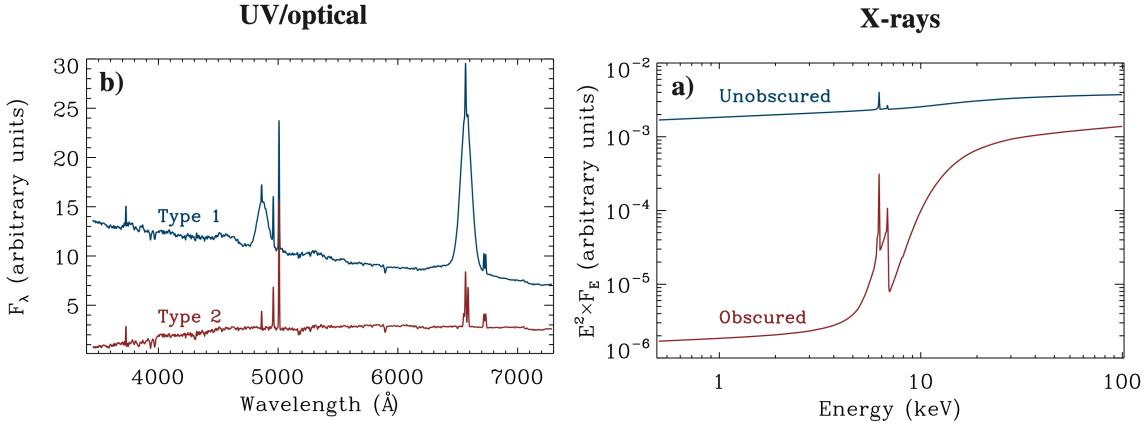
3) Summary

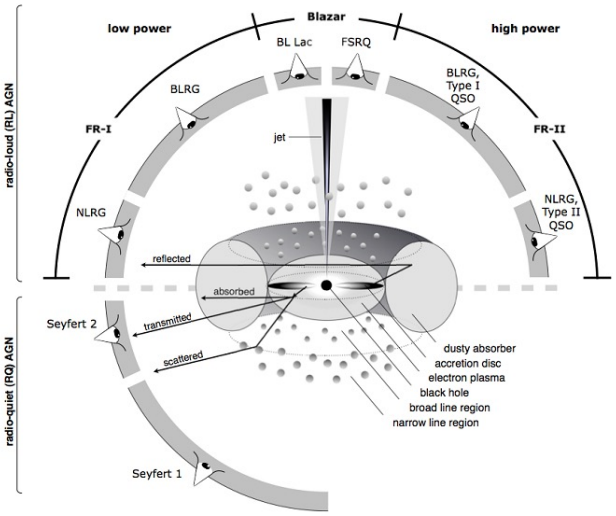
1) Active Galactic Nuclei

QSO: 3C 273

Seyfert: NGC 5548

LINER: NGC 4102



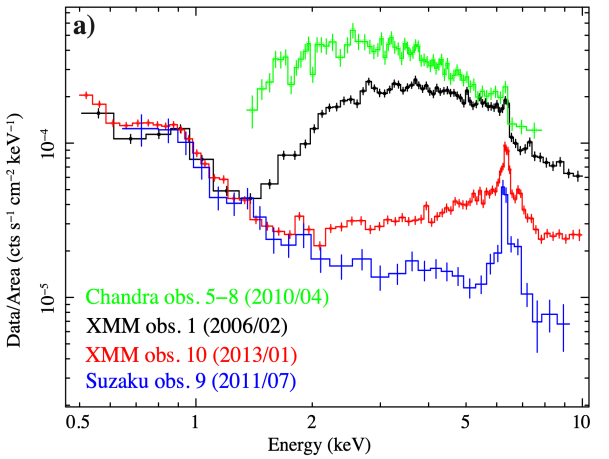


Unification AGN model based on inclination and jet

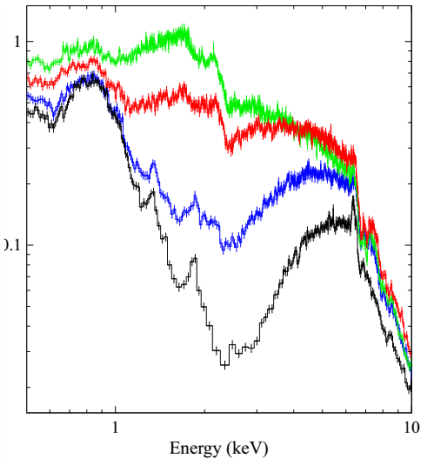
1) Challenge: Changing-look AGNs

Column density variation within several years

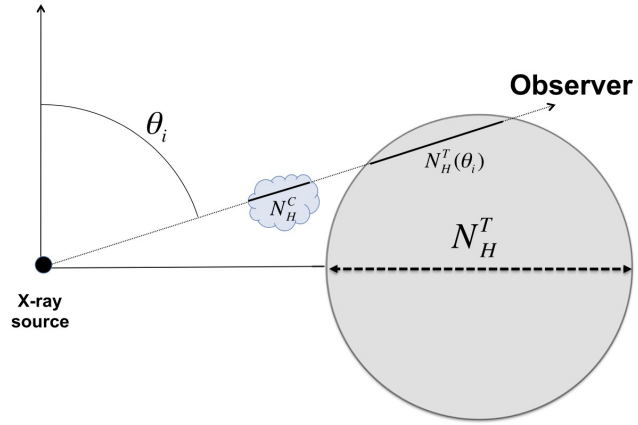
Compton-thick<->Compton thin



ESO 323-G77: Miniutti et al. 2014



NGC 1365: Walton et al. 2014



Ricci et al. 2016

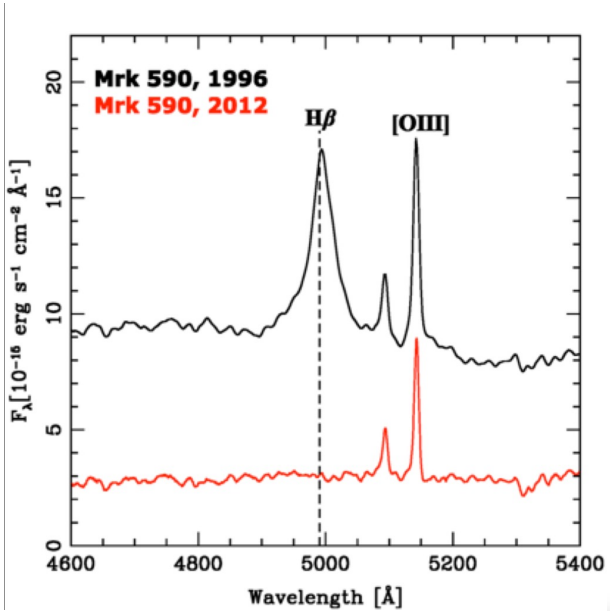
Absorption variation:

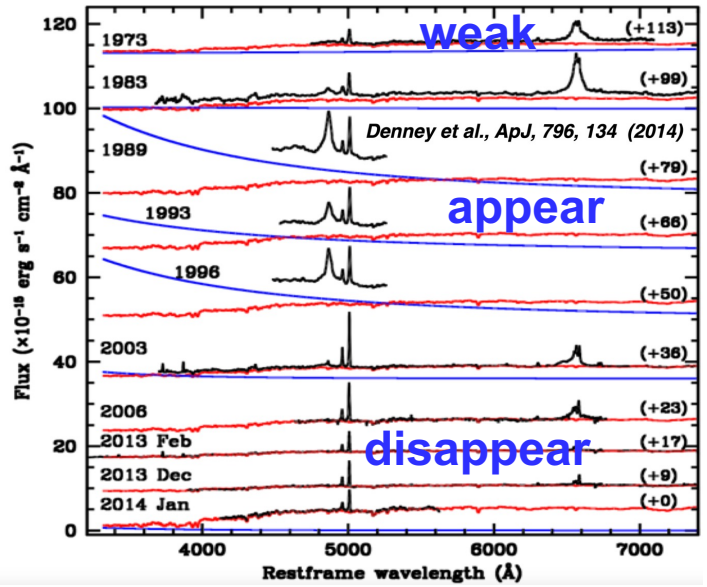
Eclipses: clouds moving in/out from our LOS?

1) Challenge: Changing-look AGNs

Disappearance or re-appearance of broad lines

Type 1<->Type 1.8-2.0 optical CLAGNs



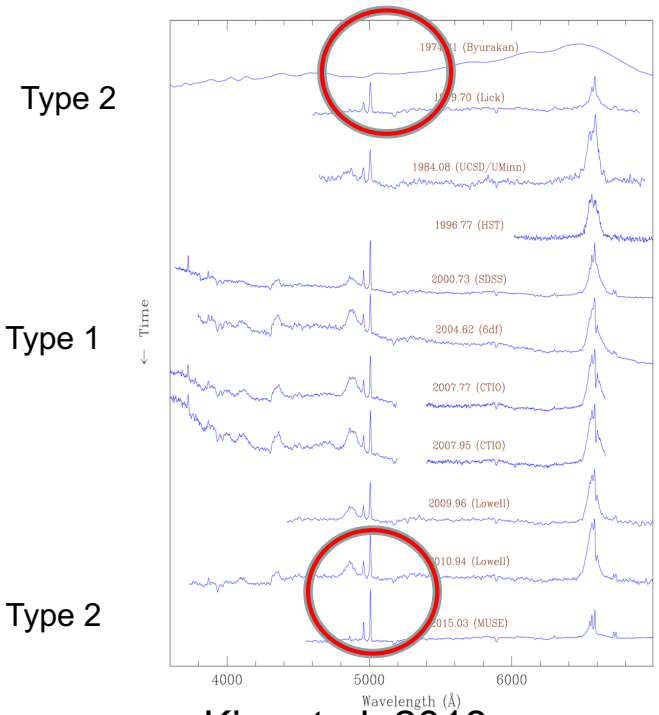


Mrk 590 Denney et al. 2014

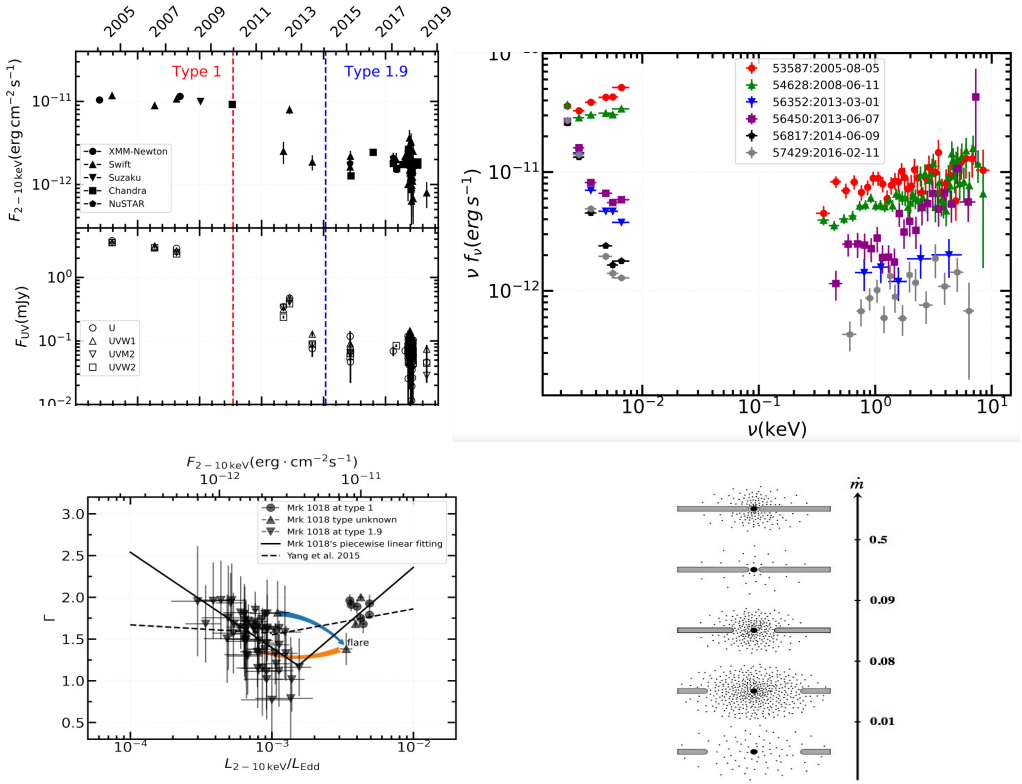
What's the physical mechanism for the CLAGNs within several years?

2.1) Mrk 1018: state transition

Strong variability in multiband FLUX and SED during changing look



Kim et al. 2018



NH is always low!

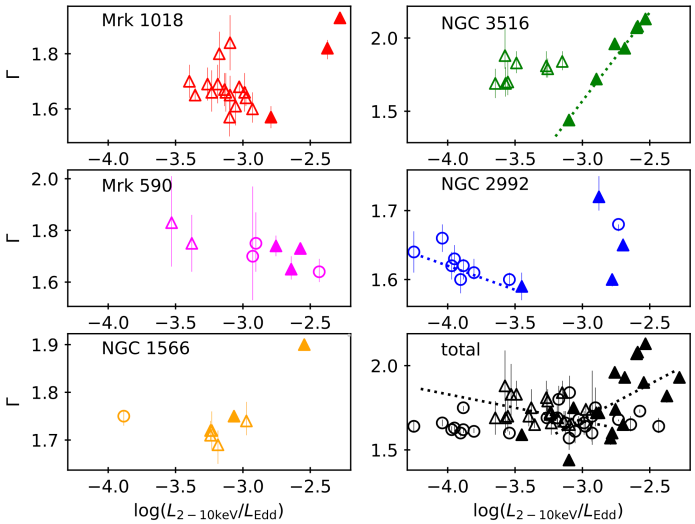
Lyu, B… Wu* et al. 2021 MNRAS

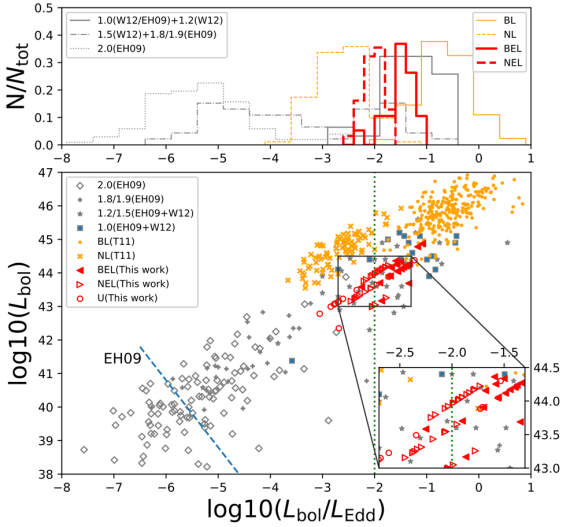
Evidence for possible transition of cold standard disk and hot ADAF,
T_e~constant in ADAF/corona, mainly regulated by optically depth

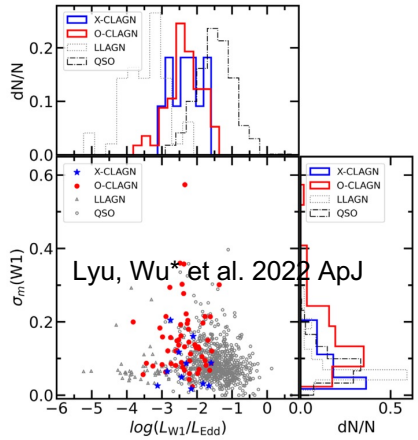
2.1) Other transition-type CLAGNs

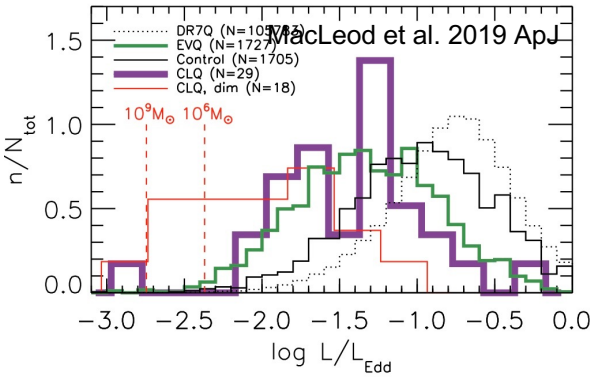
Similar case for other CLAGNs

Liu, Wu* et al. 2022 ApJ







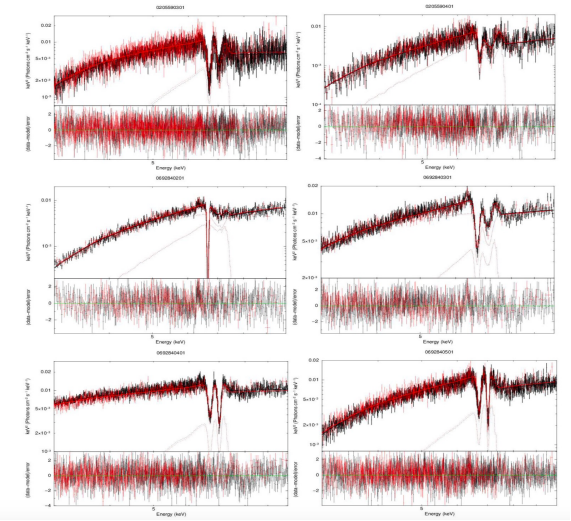


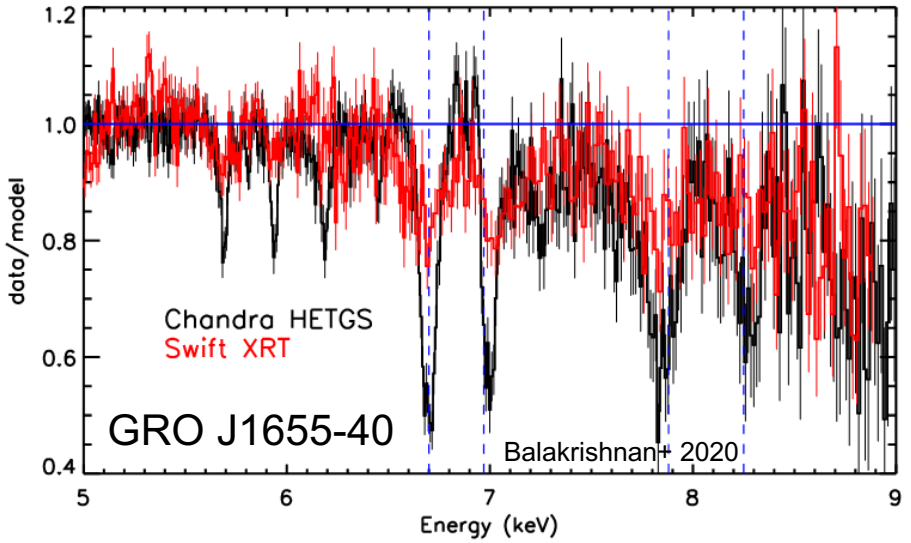
L_{IR}/L_{edd} of CLAGNs lies between LLAGNs and QSOs

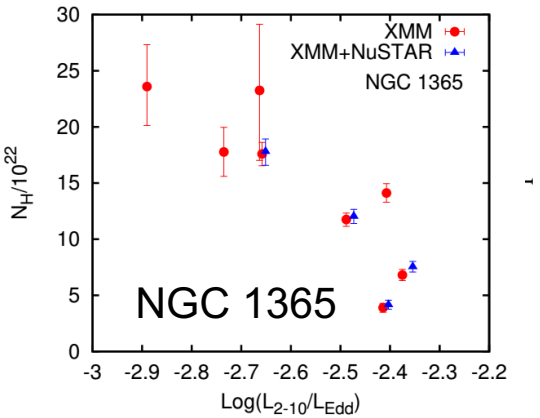
Most CLAGNs or QSOs have low Eddington ratios Lbol/Ledd ~10^{-2}

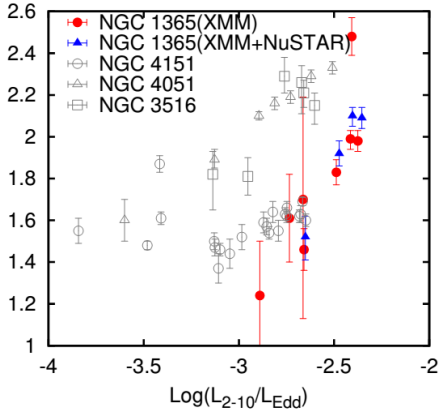
2.1) Other transition-type CLAGNs

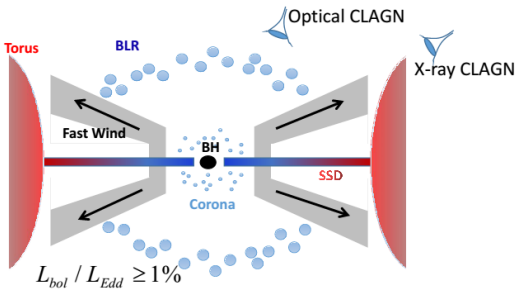
X-ray CLAGNs: disk wind + large view angle ?











Liu, … Wu* et al. 2021

2.2) Emission line Evolution

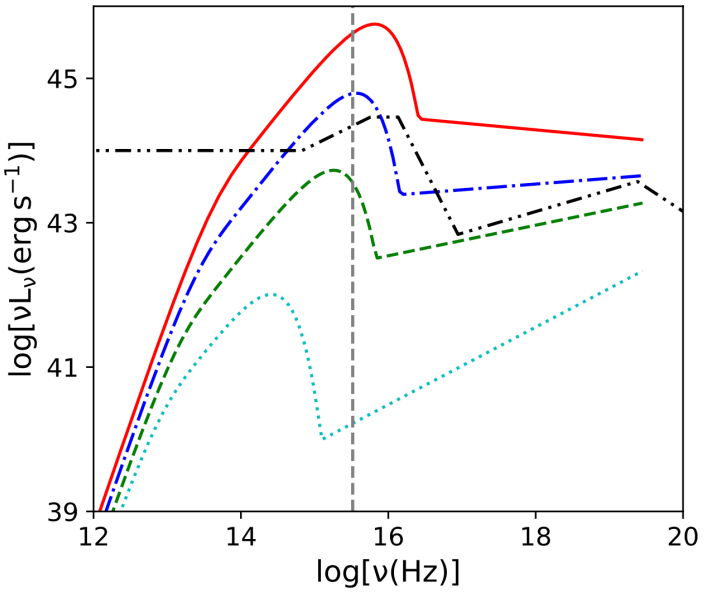
Why Halpha/beta lines varies in CLAGNs?

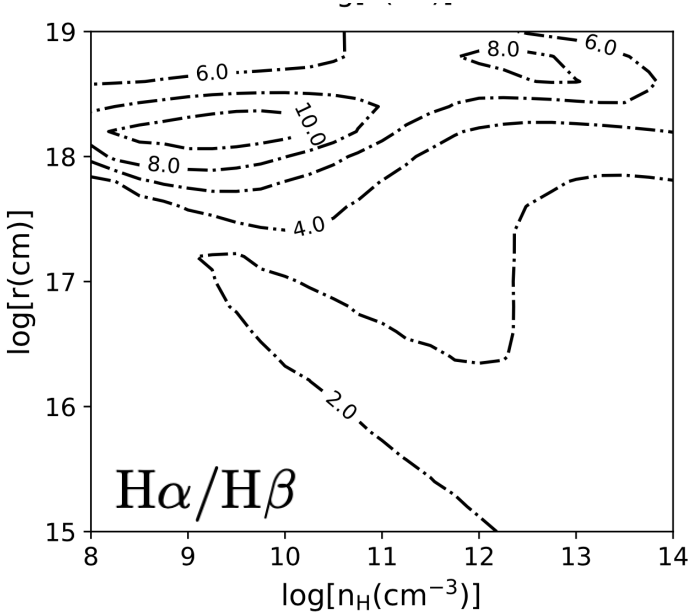
Balmer decremen: AGN internal reddening?

How lines evolve with variation of inization spectrum?

Simulation with CLOUDY code by considering different photonization model:

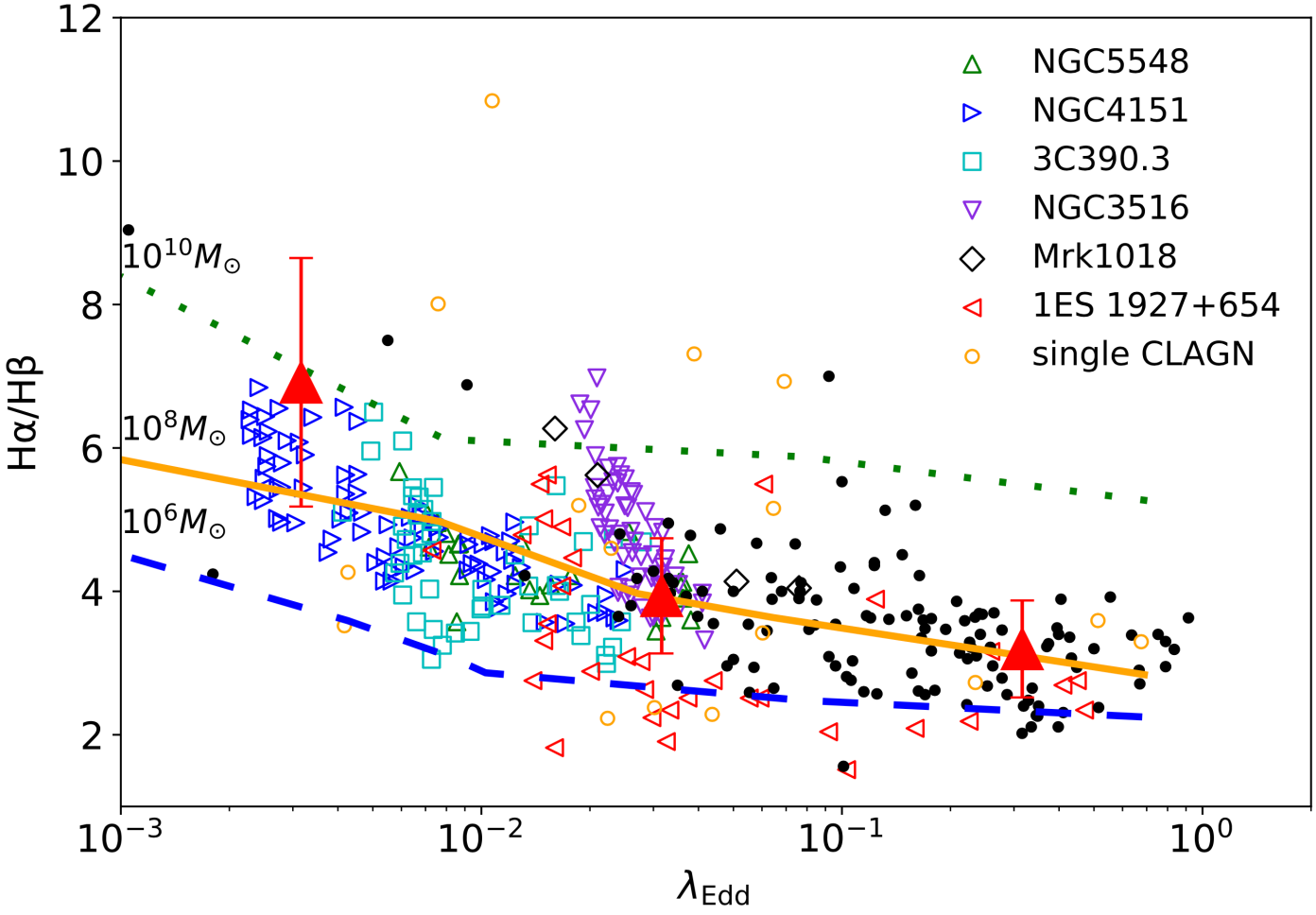
incident spectrum is considered disk-corona evolution.





2.2) Emission line Evolution

Hα/Hβ show anti-correlation with Lbol/Ledd



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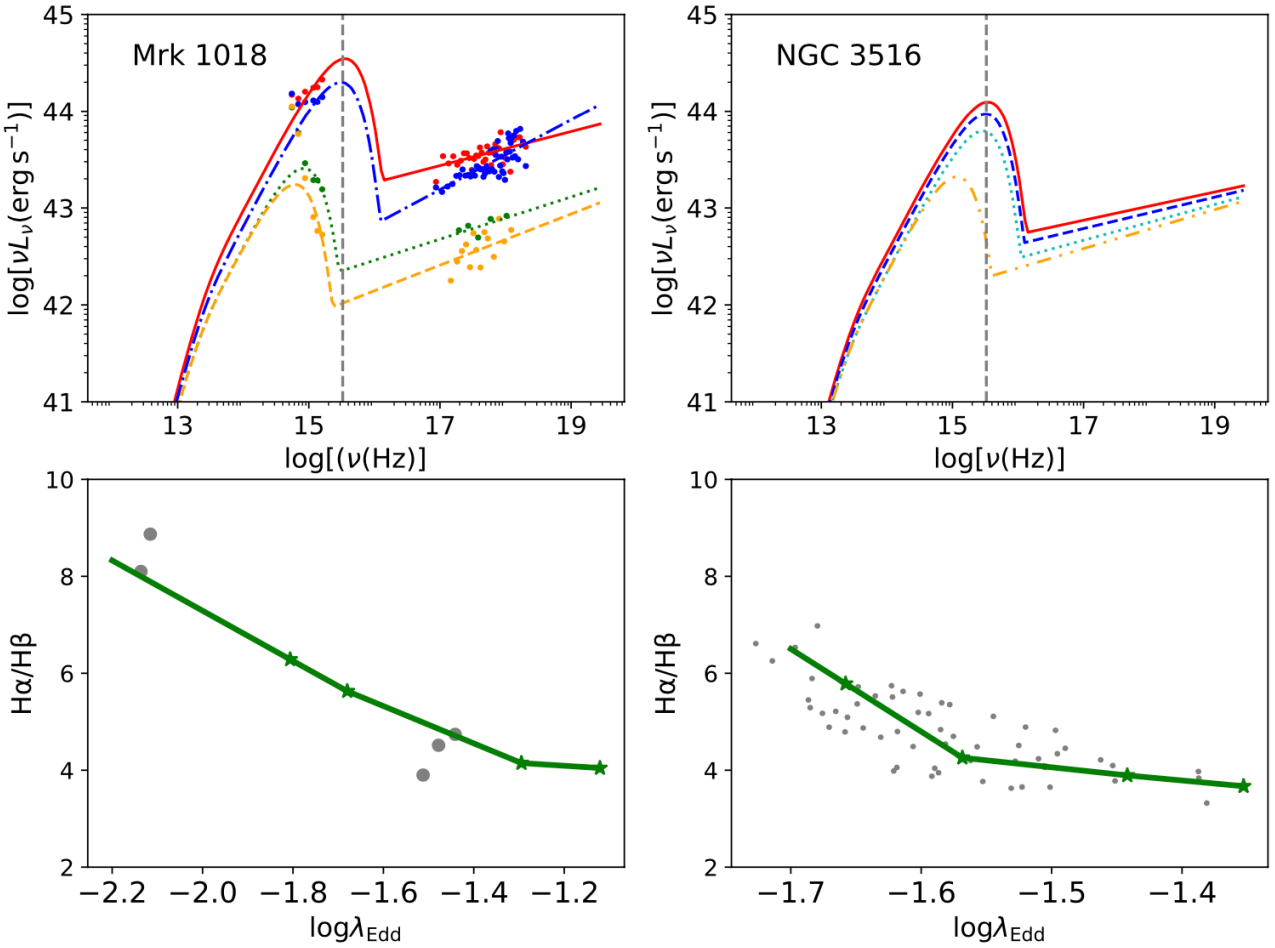


2.2) Emission line Evolution

Physical reason: Optical Depth Effect

Optical depths of Balmer lines will increase as increase of ionization luminosity.

The responsivity of $H\alpha$ is always lower than that of $H\beta$ due to $\tau_{H\alpha} > \tau_{H\beta}$. Therefore, the variation of $H\beta$ line is more evident during changing look.

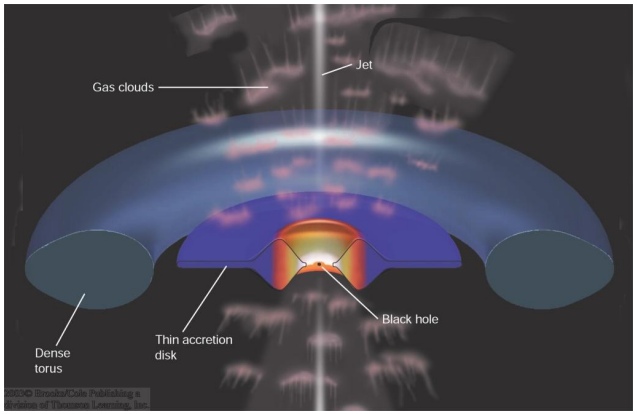
Steeper correlation with L/Ledd<1% is cuased by faster decrease of UV photons when inner SSD transit to ADAF.

3) Summary

1)CLAGNs are mainly trigered by the variation of continuum due to the fast transition between ADAF and SSD at Lbol/Ledd~1%, which are similar to the state transition in X-ray binaries.

2)It is still unclear for the mechanism that trigger the fast disk transition within a couple of years.

3)It will shed light on the broad lines, torus, jet and disk winds etc from a static picture to dynamic one.



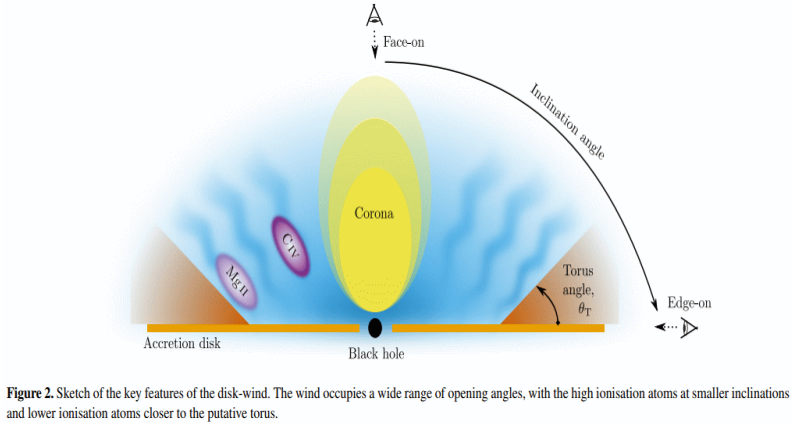


Figure 2. Sketch of the key features of the disk-wind. The wind occupies a wide range of opening angles, with the high ionisation atoms at smaller inclinations and lower ionisation atoms closer to the putative torus.

Thanks for your attention!