RSN4 Astrofisica Relativistica e Particelle @OAS

AGN accretion and ejection

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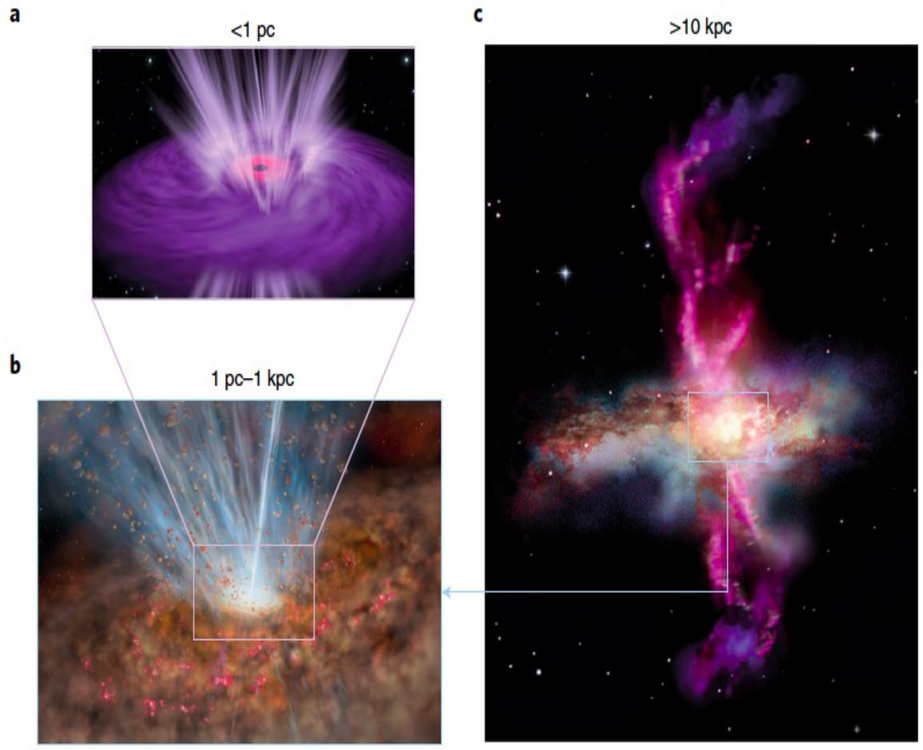
Thesis day – 5/2/2024 – Giorgio Lanzuisi – giorgio.lanzuisi@inaf.it

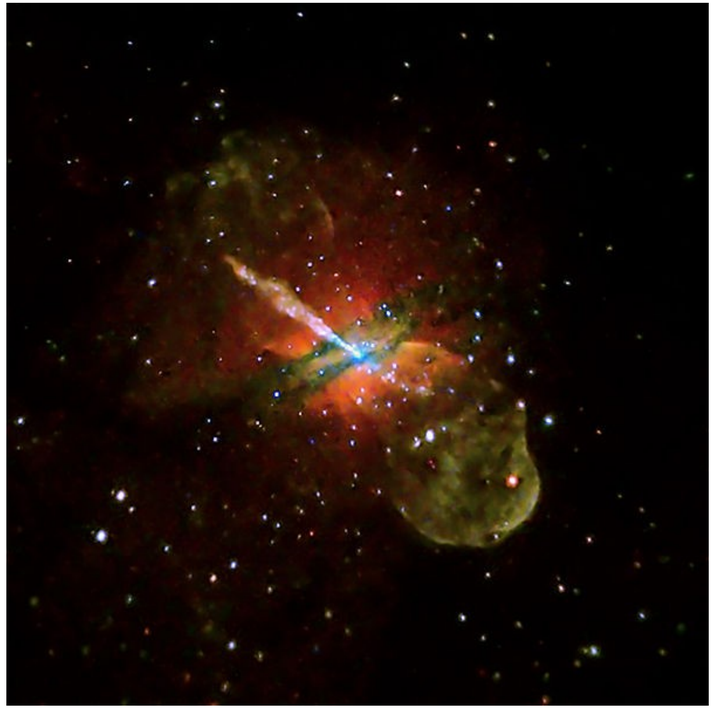
Accretion and ejection flows in nearby and distant SMBH (AGN feedback -> formation and evolution of galaxies)

Radio Quiet



Cicone, Brusa et al. 2018 Nature Astronomy, 2, 176

Radio Loud



Centaurus A, Credit: ESO

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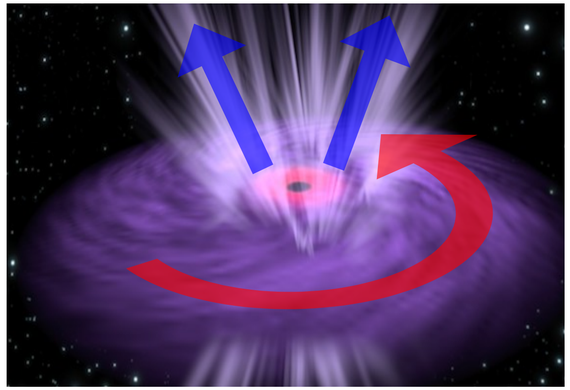
RQ AGN: accretion and ejection flows in nearby AGNs ...through **X-ray** spectroscopy/timing/imaging

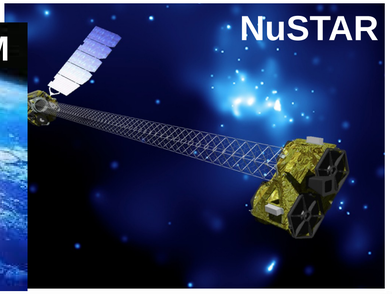


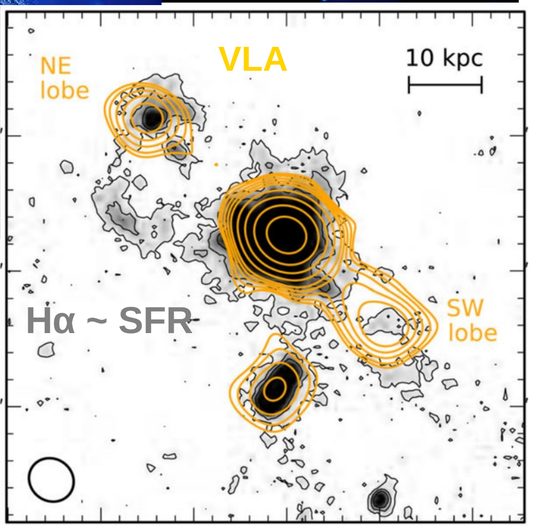
- Characterize the geometry and velocity of the outflow/wind, and its impact on the host galaxy

- Characterize the geometry and mode of the accretion flow

SUBWAYS: 1.6Ms *XMM* time (PI Brusa) to study 20 nearby QSOs
(Matzeu+23, Mehdipour+23)

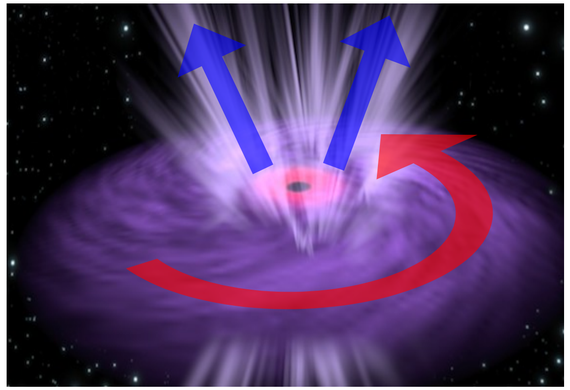
- coronal properties (*NuSTAR* LP data)
- radio-corona connection (VLA data at 1.4 and 6 GHz)
- peculiar sources (“The Beetle”, new VLA and LOFAR data)





OAS people: M. Brienza, G. Lanzuisi
Contact person @DIFA: M. Brusa

RQ AGN: accretion and ejection flows in nearby AGNs ...through **X-ray** spectroscopy/timing/imaging



- Characterize the geometry and velocity of the outflow/wind, and its impact on the host galaxy

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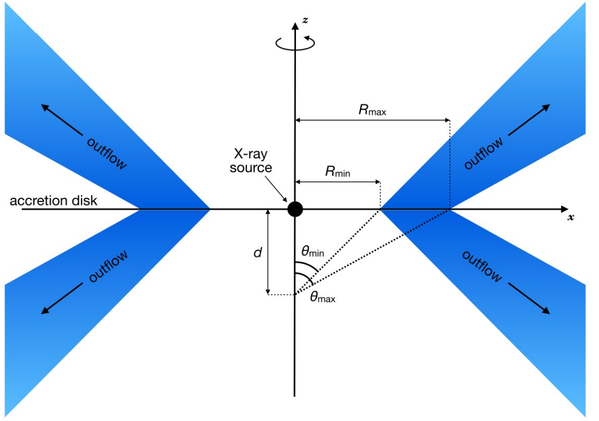
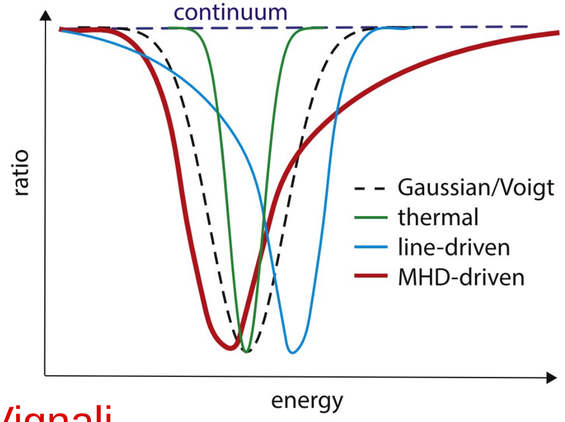
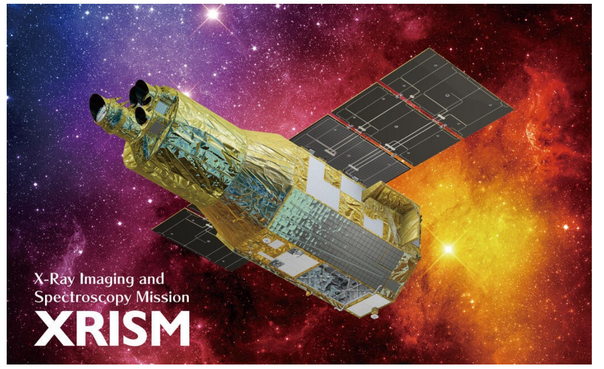
- X-Ray Accretion Disc-wind Emulator (**XRADE** Matzeu+22)
- Magnetically-driven wind (Fukumura,Dadina+23)

Simulate (and later fit) high spectral resolution data from XRISM (launched Sept. 2023, Cycle 1 obs. start Aug. 2024)







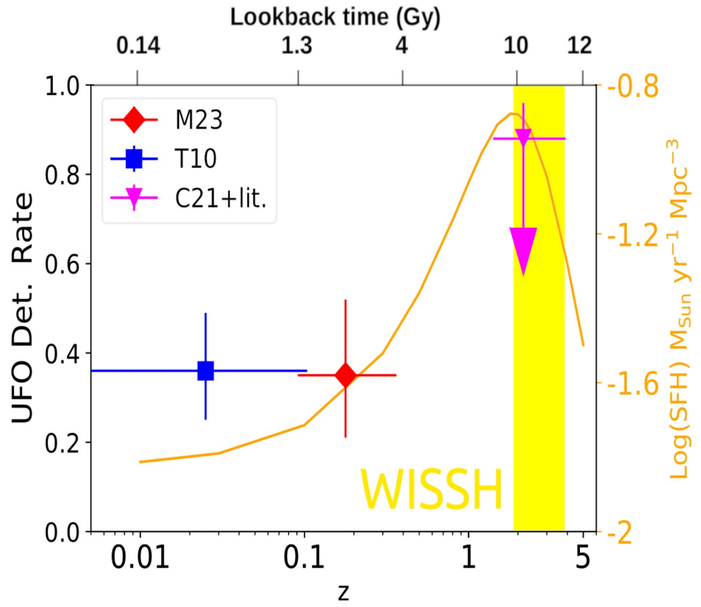
OAS people: M. Dadina, M. Cappi
Contact person @DIFA: M. Brusa, C. Vignali

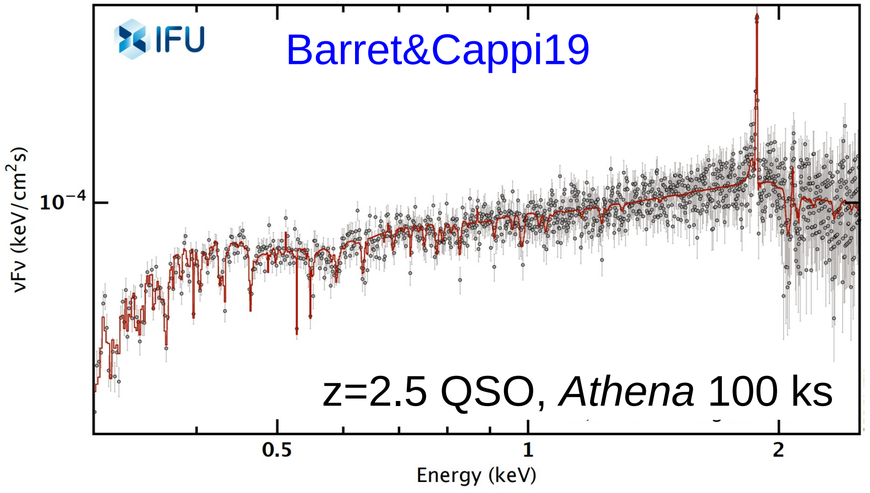
RQ AGN: accretion and ejection flows in high-z AGNs ...through **X-ray** spectroscopy

- Search for disk wind signatures in high-z (z>1-2) QSOs
Past *XMM* and *NuSTAR* programs + **WISSHFUL** *XMM* Heritage program (2.2Ms, PI Lanzuisi) + archival observations

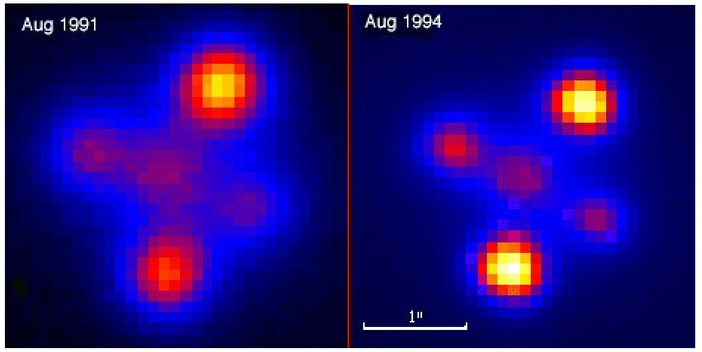
- Lensed QSOs (*XMM* and *Chandra* data)

- Simulations of *Athena* XIFU (high spectral resolution) obs. of high-z QSOs



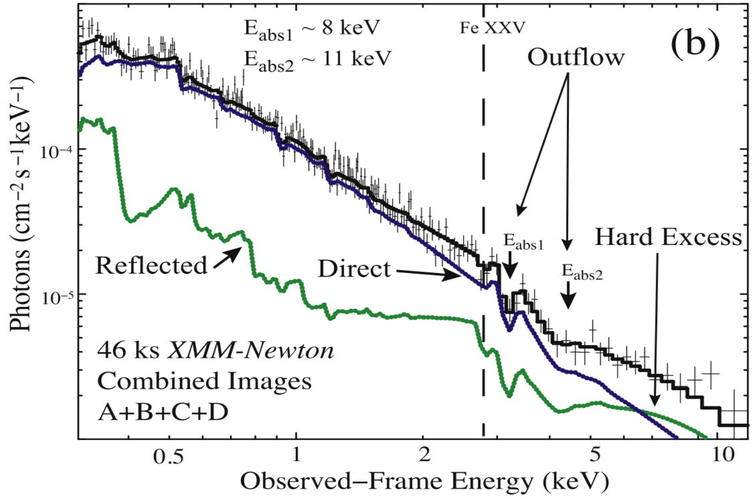


Einstein Cross (z=1.695)



Bertola+20, Chartas+21

HS 0810+2554 z=1.51



Chartas,Cappi+16

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AGN Radio-Loud

A quali domande cerchiamo di rispondere?

- Perché alcuni AGN producono getti e altri no?
- Perché alcune radio galassie sono in grado di produrre getti che raggiungono grandi distanze mentre altre rimangono compatte?
- Come sono fatti i getti?
- Di cosa sono fatti i getti?
- Sono i getti sorgenti di neutrini ?

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OAS people: P. Grandi, E. Torresi
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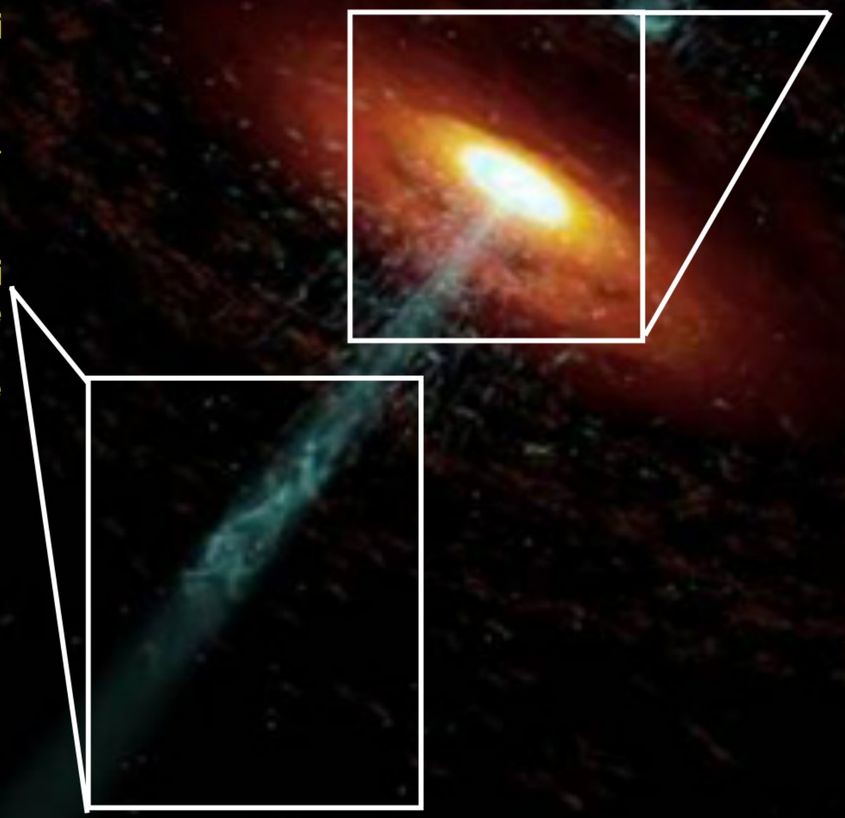
AGN Radio-Loud

Jets:

- **Fermi-LAT+MW**: caratterizzazione delle proprietà fisiche dei getti attraverso fit delle SED con modelli leptonici. Confronto tra FRI e FRII.

- **Simulazioni di sorgenti radio estese con CTA**: verificare l'osservabilità di getti estesi e lobi nella banda TeV con CTA.

- **Simulazioni di possibili sorgenti extragalattiche di neutrini** (jets) con CTA: definizione di una possibile strategia osservativa.



Accretion-ejection:

- **X-ray/NuSTAR:** studio dei processi di accrescimento. In particolare riga del ferro, componente/i di riflessione , cut-off ad alta energia. Confronto con AGN Radio-Quiet.

- **X-ray/ATHENA:** definizione di casi scientifici focalizzati allo studio dell'accrescimento e del getto a differenti scale (getti, lobi, hot-spots).

- **STUDIO DEL FEEDBACK:** caratterizzazione dell'ambiente circum-nucleare degli AGN Radio-Loud attraverso la spettroscopia X ad alta risoluzione e studio del tipo di feedback in atto.

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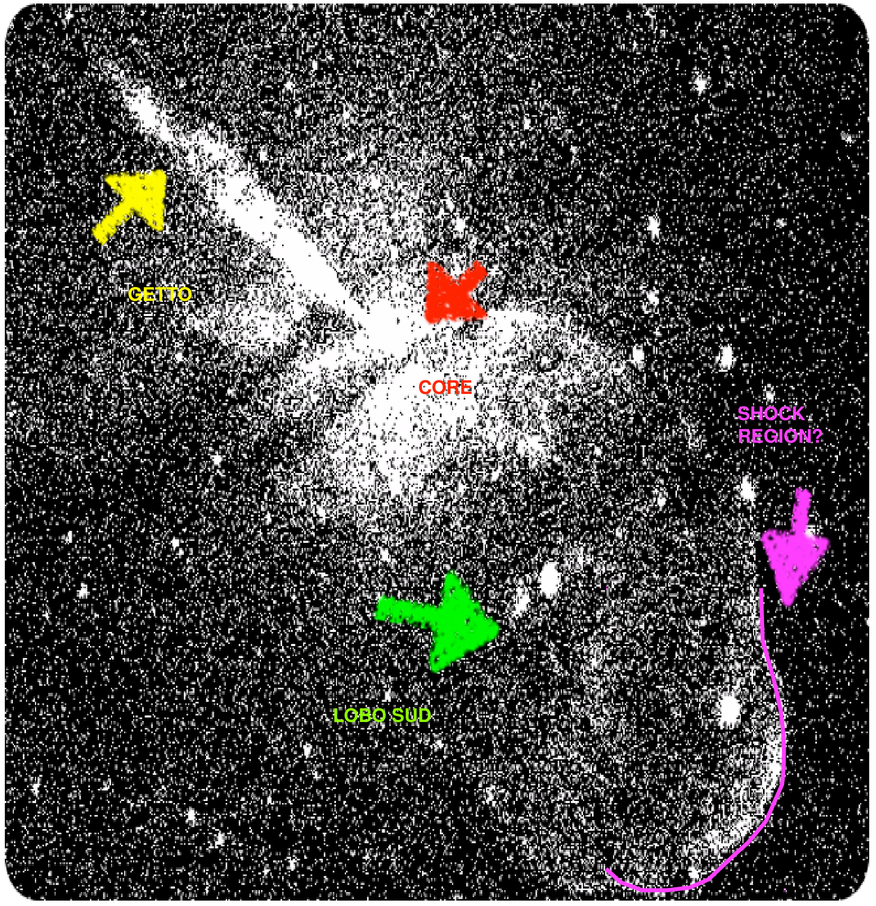
Studio X spazialmente risolto di radio galassie vicine: ***Centaurus A***

Chandra ACIS-I 0.3-7 keV mosaic (750 ks)



Obiettivi del progetto:

i. studio X spazialmente risolto del getto e del lobo sud con mosaico di immagini *Chandra;*

ii. studio dei processi fisici non-termici (getto, lobo) con l'ausilio di dati Fermi-LAT nella banda gamma (>100 MeV) e H.E.S.S. nella banda TeV; E' Centaurus A una possibile sorgente di neutrini?

iii. studio dei processi fisici termici (possibili regioni di shock)

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