UFOs in AGNs with EmulatoRs:
UAGNER

(Linkeed to the scheda UAGNER – Mauro Dadina)

Goal: **test and validate, both on technical and physical basis on real CCD data, machine learning based emulators (XRADE but not only) of radiation driven disk winds (DW) in AGN.**

How: X-ray data analysis of different kinds of AGN in the local Universe →

1) Testing of the basic DW model (using DW spectral tables);
2) testing the emulator XRADE (Matzeu et al. 2022);
3) (added!) testing different scenarios (magneto-hydrodynamic models, MHD, Fukumura et al. 2010, 2015; Fukumura, MD et al. 2022)

Members: Mauro Dadina (INAF/OAS), Gabriele Matzeu (DIFA UniBO and INAF/OAS… now ESA)

Proposed timetable and status:

1) within end of June 2022 (+ ~10/12 months due to funding availability/programm starting in February 2023): definition of the sample of 2/3 Seyfert and radio-loud galaxies; Done

i) IRAS F11119+3257 → ULIRG, UFO detected with NuSTAR (Tombesi et al. 2017)

Paper almost submitted and based on new XMM-Newton+NuStar data (Lanzuisi et al. in prep): Tested the radiation driven wind (DW) model table at the base of XRADE. To be done: test XRADE, WINE (Luminari et al. 2021) and MHD models (Fukumura et al. 2010, Fukumura, MD, et al. 2022).

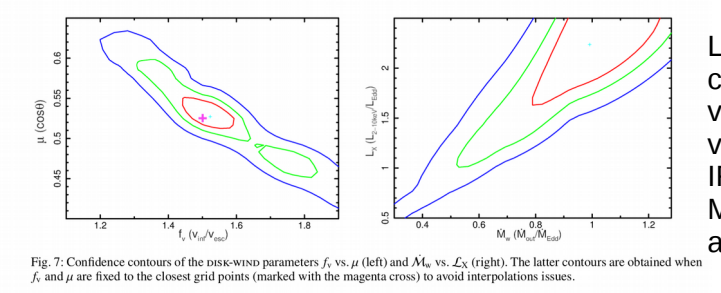

Fig. 7: Confidence contours of the DISK-WIND parameters f_v vs. μ (left) and $\dot{M}_w$ vs. $\mathcal{L}_X$ (right). The latter contours are obtained when f_v and μ are fixed to the closest grid points (marked with the magenta cross) to avoid interpolations issues.

Lanzuisi et al. to be sumitted: Confidence contour of the incl. angle vs. outflow velocity (left panel) and of the Edd. Ratio vs mass outflow rate as obtained for IRAS F11119+3257 using the disk wind Model (Sim et al. 2008, 2010; Matzeu et al. 2022)

ii) 3c 120 → BLRG, UFO detected using Suzaku data (Gofford et al. 2013)

Paper in preparation using XMM-Newton+NuSTAR data (Dadina et al. in prep): Tested the radiation driven wind model table at the base of XRADE: to be done: test XRADE and MHD model before submission (this work will be done in close contact with Gabriele Matzeu and Keigo Fukumura)

iii) MCG-03-58-007 → Seyfert 2 galaxy, UFO detected using XMM-Newton data (Matzeu et al. 2019). DW model already tested in Braito et al. 2022 (not within the context of this project). To be done: test XRADE and MHD model before submission (this work will be done in close contact with Gabriele Matzeu and Keigo Fukumura)

2) within end of September 2022 (+10/12 months) first results of data analysis using XRADE; Done for the testing of the DW model (see above). To be done: testing XRADE

3) within end of November 2022 (+10/12 months) simulations of the obtained spectral set-up with the Athena/X-IFU and XRISM-Resolve response matrices; delays in the production of high-resolution tables for the DW model due to problems in purchasing high performance computer (costs increases and time). **Some available high-resolution table already used to evaluate the newAthena capabilities in coordination with the Athena Science Redefinition Team of ESA.**

4) within summer/winter 2023 (+10/12 months) publication of the first results. Some publications almost ready

Forseen path:

1) Within the end of spring 2024: submission of the papers on IRAS F11119 and 3c120 using DW models

2) Within the summer/autumn 2024: submission of the papers on MCG-03 based also on MHD models

3) Within the end 2024: publication of the XRADE results if not done in the DW papers

4) 2024: preparation of the first Xrism proposal using high-resolution DW and MHD tables (to be verified the availability of high-resolution tables of the DW model, see below).

5) added… using machine learning tech. also for MHD models? (strong collaboration with Keigo Fukumura of James Madison University)

Critical issues:

a) Hugely increased costs for computing power (strong delay – months- in purchasing the needed computing power. Just arrived as of November 2023)

b) Lost of collaborators – namely Gabriele Matzeu- due to other projects (Athena/XIFU) programmatic issues

Raw financial statement:

- **Computing: ~8500 Euro**
- **Travels: ~1600 Euro**
- **Visits to INAF/OAS: ~1600 Euro (Gabriele Matzeu, Keigo Fukumura)**
- **Still available for the second year: ~6000 Euro (expected to be travels)**