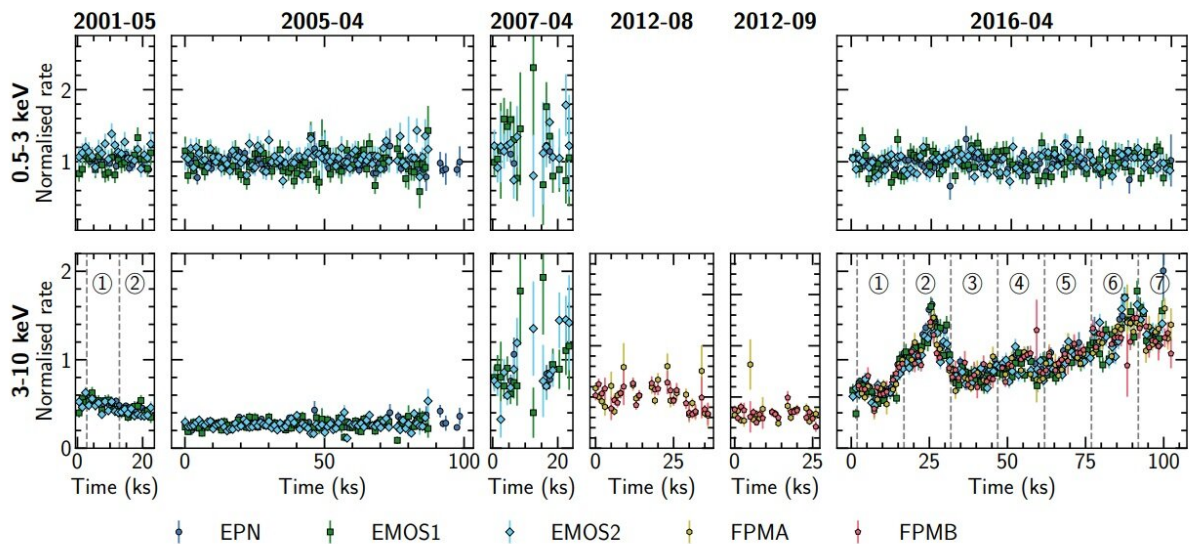


# Astronomers investigate X-ray spectral variability of active galaxy NGC 7582

April 7 2023, by Tomasz Nowakowski



Light-curves of the XMM-Newton and NuSTAR observations of NGC 7582 in the 0.5-3 keV (top panel) energy band and 3-10 keV (bottom panel) energy band. Credit: Lefkir et al, 2023

Using ESA's XMM-Newton and NASA's NuSTAR space telescopes, astronomers have observed a nearby active galaxy known as NGC 7582.

Results of the observational campaign, published March 30 on the *arXiv* pre-print server, shed more light on the X-ray spectral variability of NGC 7582's active galactic nucleus (AGN).

An AGN is a compact region at the center of a galaxy, more luminous than the surrounding galaxy light. Studies show that AGNs are very energetic due either to the presence of a black hole or star formation activity at the core of the galaxy.

Astronomers generally divide AGNs into two groups based on emission line features. Type 1 AGNs show broad and narrow emission lines, while only narrow emission lines are present in Type 2 AGNs. However, observations revealed that some AGNs transition between different spectral types; therefore, they were dubbed changing-look (CL) AGNs.

At a distance of some 73 million light years away from the Earth, NGC 7582 is a Type 2 Seyfert galaxy with a changing-look AGN. The galaxy has a diameter of about 100,000 light years and a [supermassive black hole](#) at its core with a mass of about 55 million solar masses.

Now, a team of astronomers led by Mehdy Lefkir of the University of Leicester, U.K., have analyzed the available observational data of NGC 7582 obtained with XMM-Newton and NuSTAR between 2001 and 2018. The main aim of their study was to explain the short- and long-term X-ray behavior of this source.

"To study the variability, we perform a time-resolved spectral analysis using a phenomenological model and a physically-motivated model (uxclumpy). The spectral fitting is achieved using a nested sampling Monte Carlo method. Uxclumpy enables testing various geometries of the absorber that may fit AGN spectra," the researchers explained.

It turned out that NGC 7582 exhibits a long-term variability between

observations conducted by Lefkir's team but also a short-term variability in two observations that has not been studied before. The astronomers found that the long-term and short-term variability are due to intrinsic changes in the X-ray luminosity of the source, and changes in the absorption in the line of sight.

According to the paper, this absorption is best described by a fully covering clumpy absorber. The researchers noted that the short-term variability of NGC 7582 could be explained by a spherical clump with a density profile peaking in the core and slowly decreasing towards the surface of the clump.

The results suggest that the absorber is located at a distance not larger than 1.95 light years from the X-ray source, moving with a transverse velocity exceeding approximately 700 km/s. Assuming that the absorber is a single cloud in the line of sight, the size of this cloud is estimated to be larger than 100 million kilometers.

All in all, the observations indicate the presence of a variety of cloud densities, or even a gradient in the density within a single cloud. This, according to the authors of the paper, favors a comet-shaped cloud scenario or at least a non-uniform cloud.

**More information:** Mehdy Lefkir et al, A hard look at the X-ray spectral variability of NGC 7582, *arXiv* (2023). [DOI: 10.48550/arxiv.2303.17473](https://doi.org/10.48550/arxiv.2303.17473)

© 2023 Science X Network

Citation: Astronomers investigate X-ray spectral variability of active galaxy NGC 7582 (2023, April 7) retrieved 24 April 2024 from <https://phys.org/news/2023-04-astronomers-x-ray-spectral-variability-galaxy.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.