X-RAY POLARISATION OF IC4329 A

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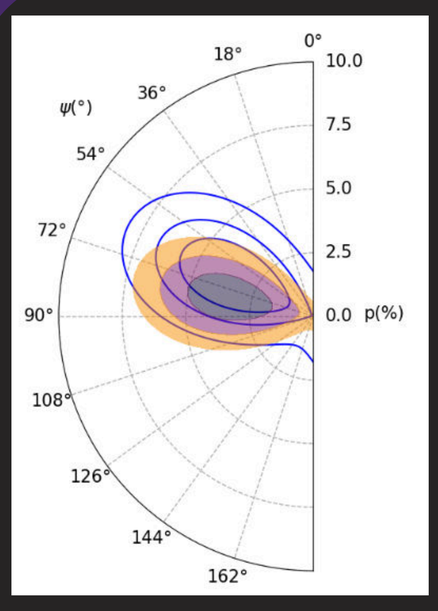
Link to paper: https://arxiv.org/abs/2305.13028

Observation

- IC4329 A : A Seyfert Type 1 galaxy belonging to the IC4329 group.
- ~500ks observation time with IXPE in 2-8keV band
- Accompanied by XMM-Newton (~60 ks, 2-10keV) and NuSTAR (~80 ks, 3-79keV) exposures

Measuring Polarisation Degree (PD) and Polarisation Angle (PA)



Comparing the 2-8 keV PD/PA constraints for different methods of data reduction and polarisation calculation:

The polar contour plot of the 68, 90 and 99% confidence levels of PD and PA.

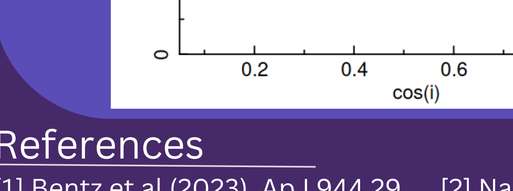
Blue hollow contours: Results from the pcube algorithm within IXPE's analysis framework 'ixpeobssim'.

Block colour contours: Results from weighting photons, a new background rejection method and fit with a simple model via XSPEC.

Formal detection significance: 2.97σ

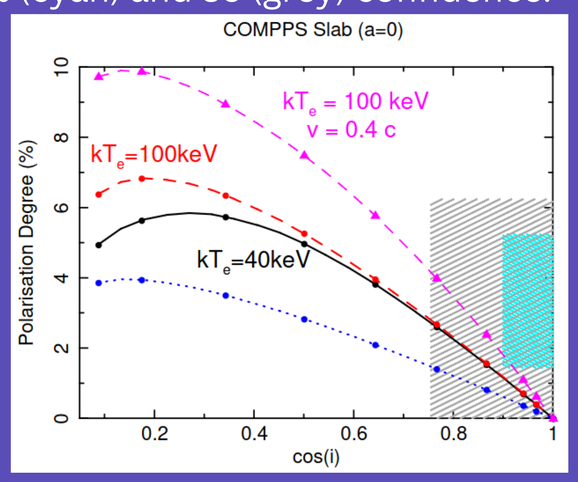
Coronal Geometries

The constraints on PD [3], PA and inclination favour coronae radially extended in the plane of the disc because the PA aligns with the radio jet . An outflowing coronal geometry has been suggested which could be responsible for the higher polarisations seen in the cases of low inclination.

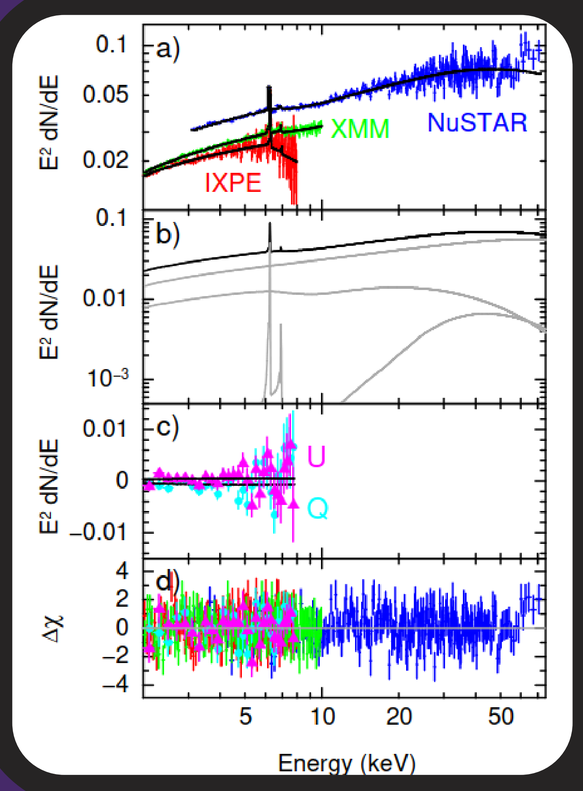


Outflowing Coronal geometry

PD of various coronal geometries as a function of the cosine of the inclination angle. The PA is set perpendicular to the disc plane. The hatched areas represent the observed PD and inclination at 90% (cyan) and 3σ (grey) confidence.



Spectro-polametric Fitting



I performed spectro-polametric analysis using XSPEC, where I simultaneously fit data from NuSTAR, XMM and IXPE. I explored fits from two different models which I will refer to as “Model 1” and “Model 2”.

Model 1

```
mbpo×zTBabs×TBabs×[nthComp+relxillCp+xillverCp]
```

Model 2

```
mbpo×ztbabs×tbabs×[cutoffpl+pexriv+laor+gauss]
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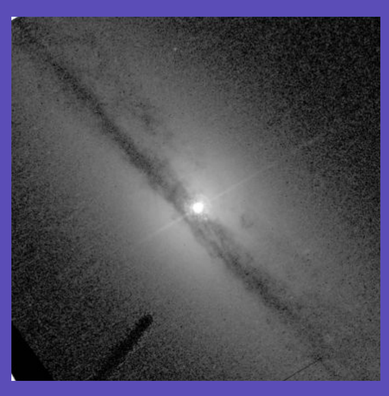
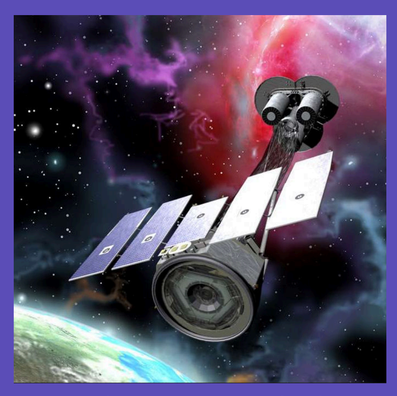
Results for Model 1 are plotted to the left.

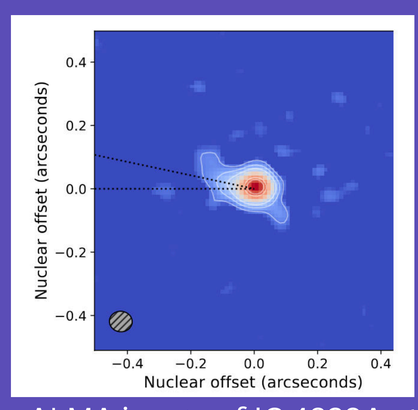
The components in each Model were then convolved with a constant polarisation component, **polconst**.



HST image of IC 4329A [1]



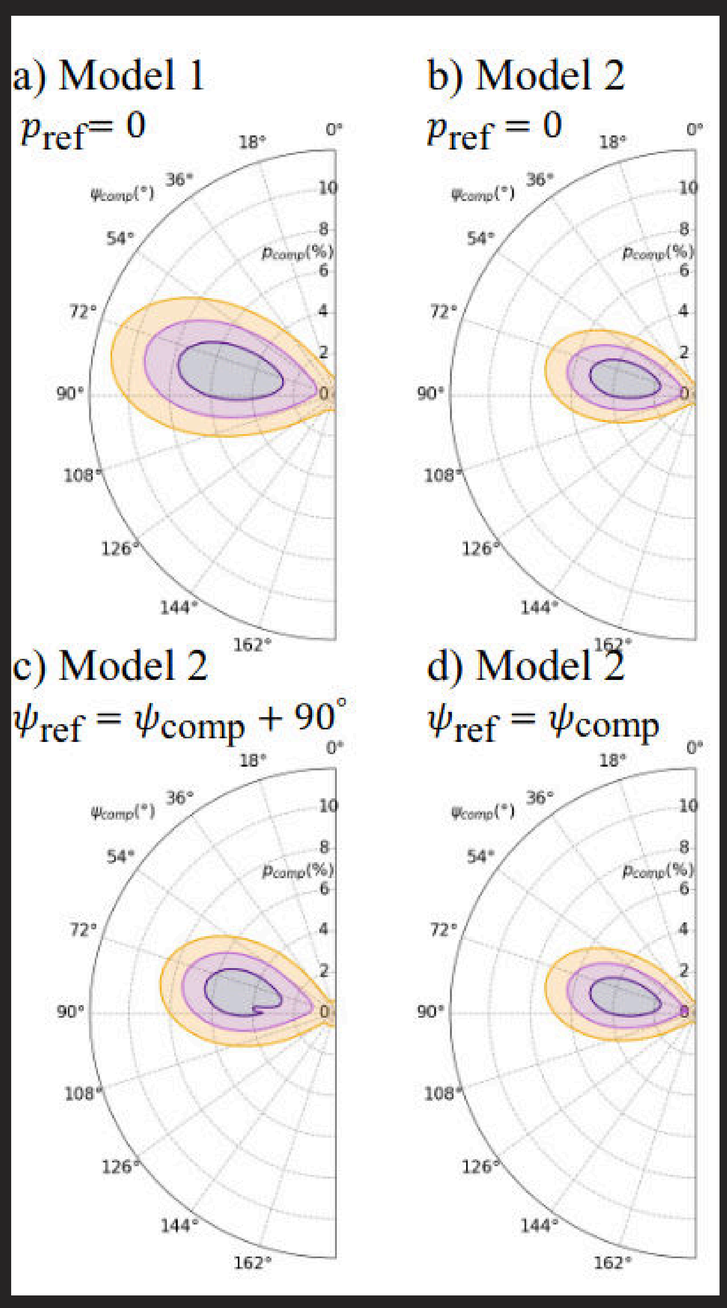
Imaging X-ray Polarimetry Explorer (IXPE)



ALMA image of IC 4329A at 100GHz

Comparing Models

Confidence contours of the direct coronal emission derived from spectro-polametric fits making the following assumptions:



a) Model 1, unpolarized reflection components. Model 1 does not allow us to separate the (unpolarized) iron line from the rest of the (polarised) reflection spectrum, so for any other assumptions, we need to use Model 2.

b) Model 2, unpolarised reflection components.

c) Model 2, PA of reflection components set perpendicular to PA of coronal component.

d) Model 2, PA of reflection components set parallel to PA of coronal component.

Both spectral models place constraints on the inclination angle of the accretion disc via the profile of the relativistically smeared iron line [2]. Model 2 underestimates the flux coming from the corona because it combines the properties of the disc and distant reflectors into one object.

From the ALMA image of IC4329 A at 100GHz we observe that the jet emission is consistent with a position angle of ~90°, and broadly so with our observations of PA at ~78°. This property is consistent with previous IXPE observations of NGC 4151 [4] and Cygnus X-1 [5].

References

[1] Bentz et al (2023), ApJ 944 29 [2] Nandra et al (1997) ApJ 477 602 [3] Ursini et al 2022, MNRAS, 510, 3674 [4] Gianoli et al (2023), arXiv:2303.12541 [5] Krawczynski et al (2022) Science 378, 650