Hidden Magnetic Accretors in Cataclysmic variable Stars

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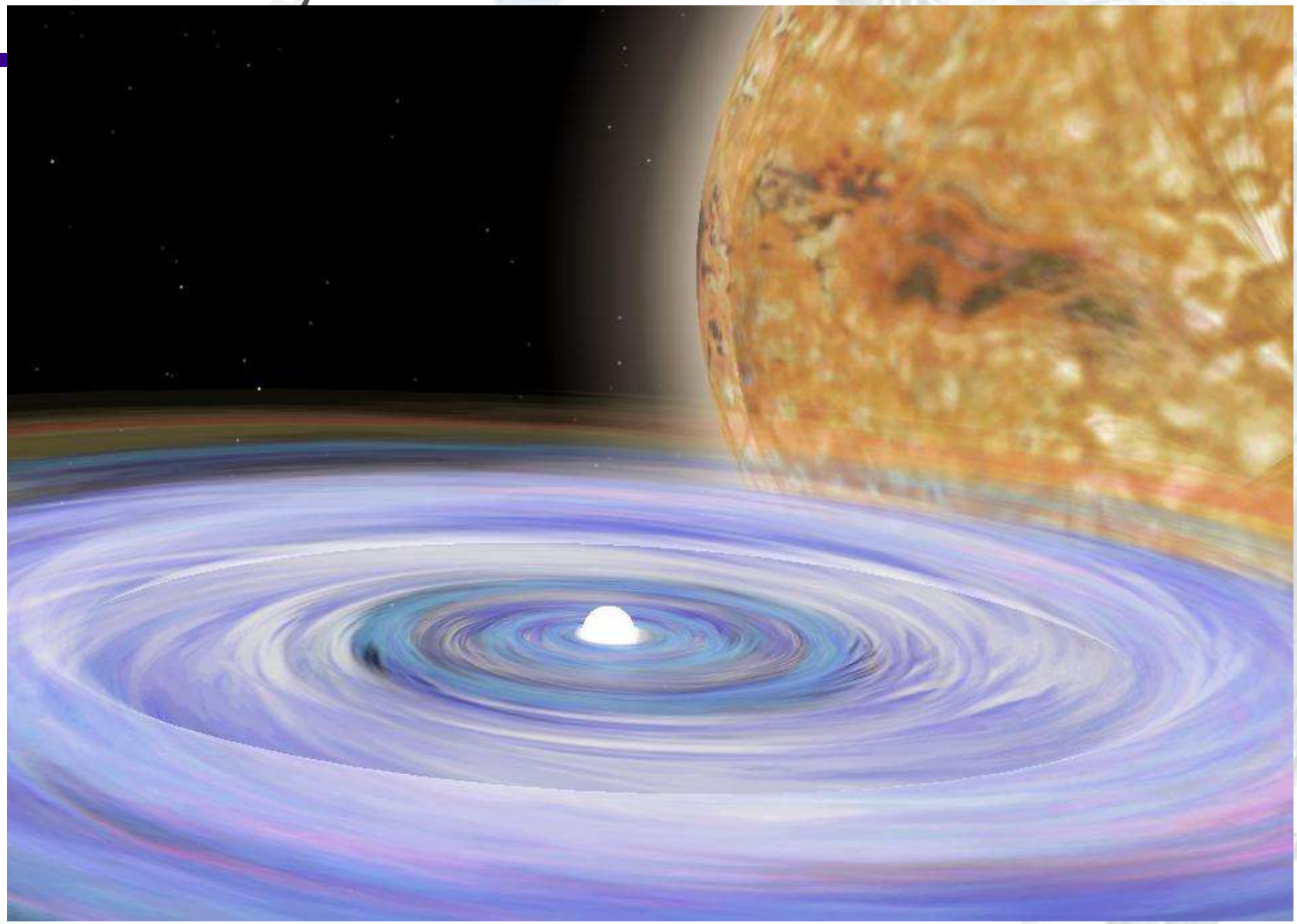
THE UNIVERSITY OF WARWICK

Cataclysmic variables



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Visualisation by Chris Moran & myself using Celestia

Cataclysmic variables

Talk Overview

- A surprising result from ASCA…

- …and the problems with ASCA observation

- Temporal results from XMM-Newton

- Spectral results from XMM-Newton

- Interpretation & conclusion

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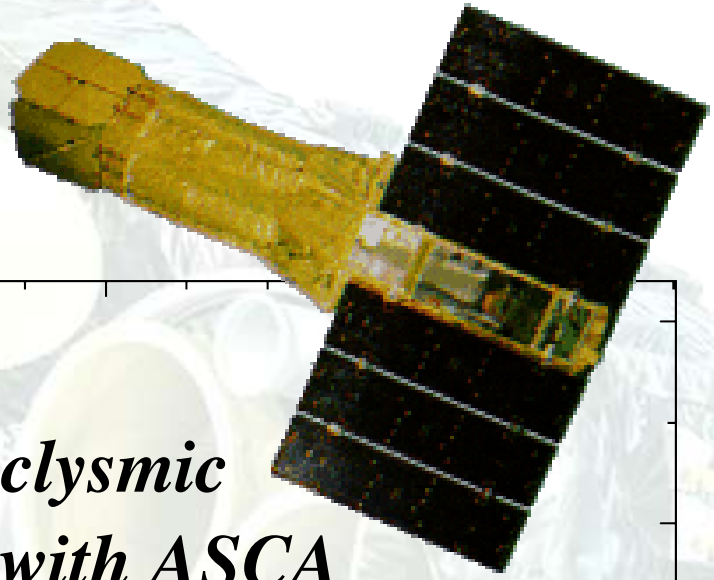
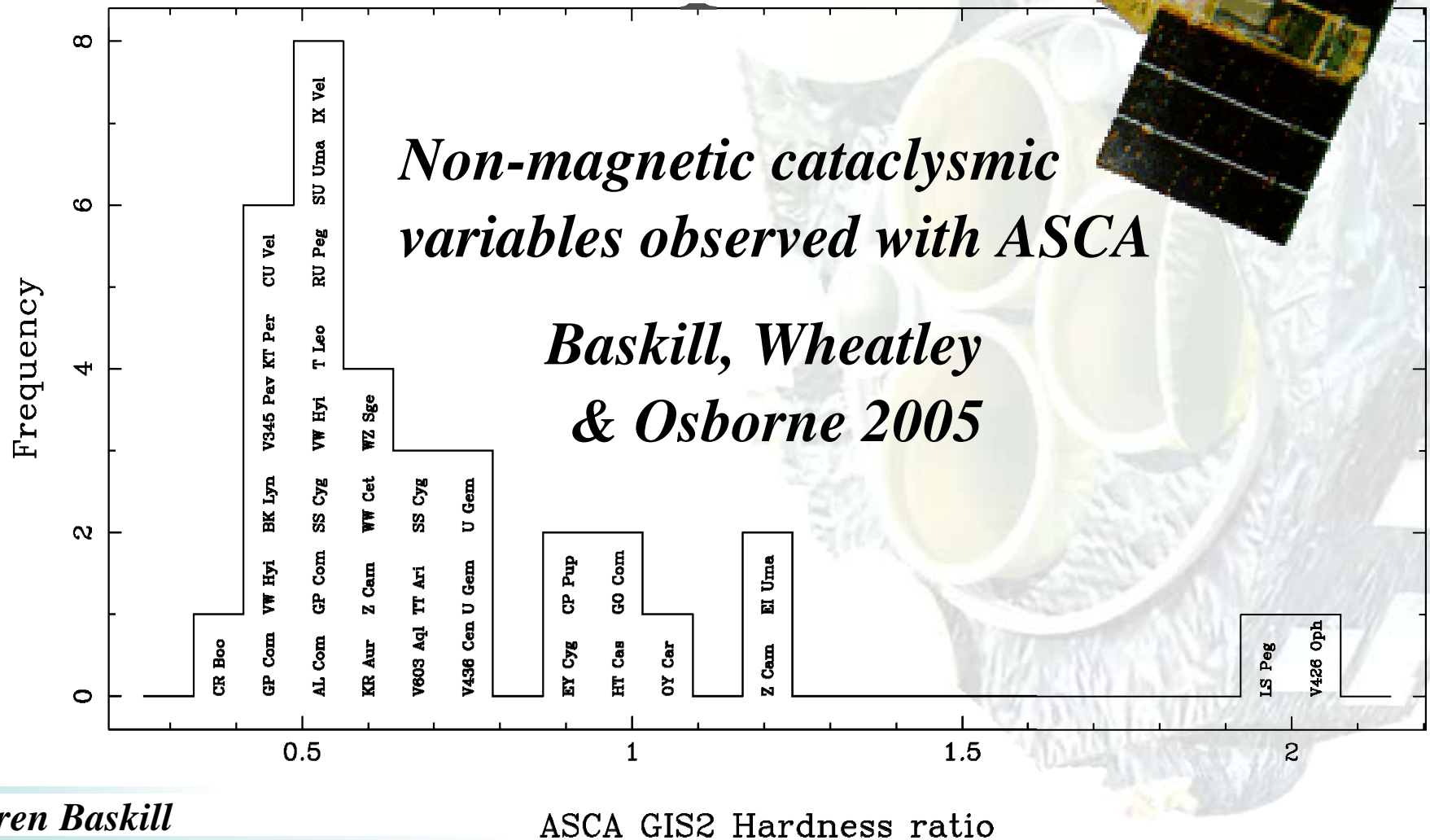
ASCA sample



Non-magnetic cataclysmic variables observed with ASCA

Baskill, Wheatley & Osborne 2005



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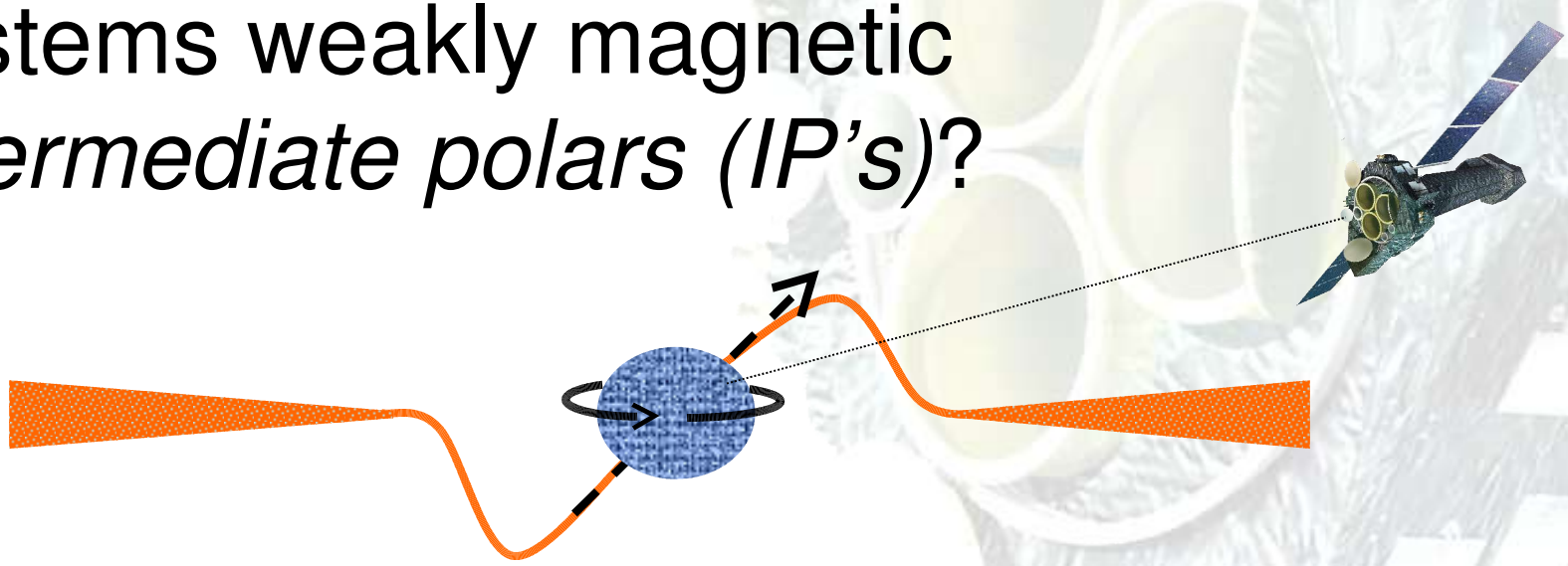
X-ray hardness

Are the white dwarfs in these systems weakly magnetic *intermediate polars (IP's)*?



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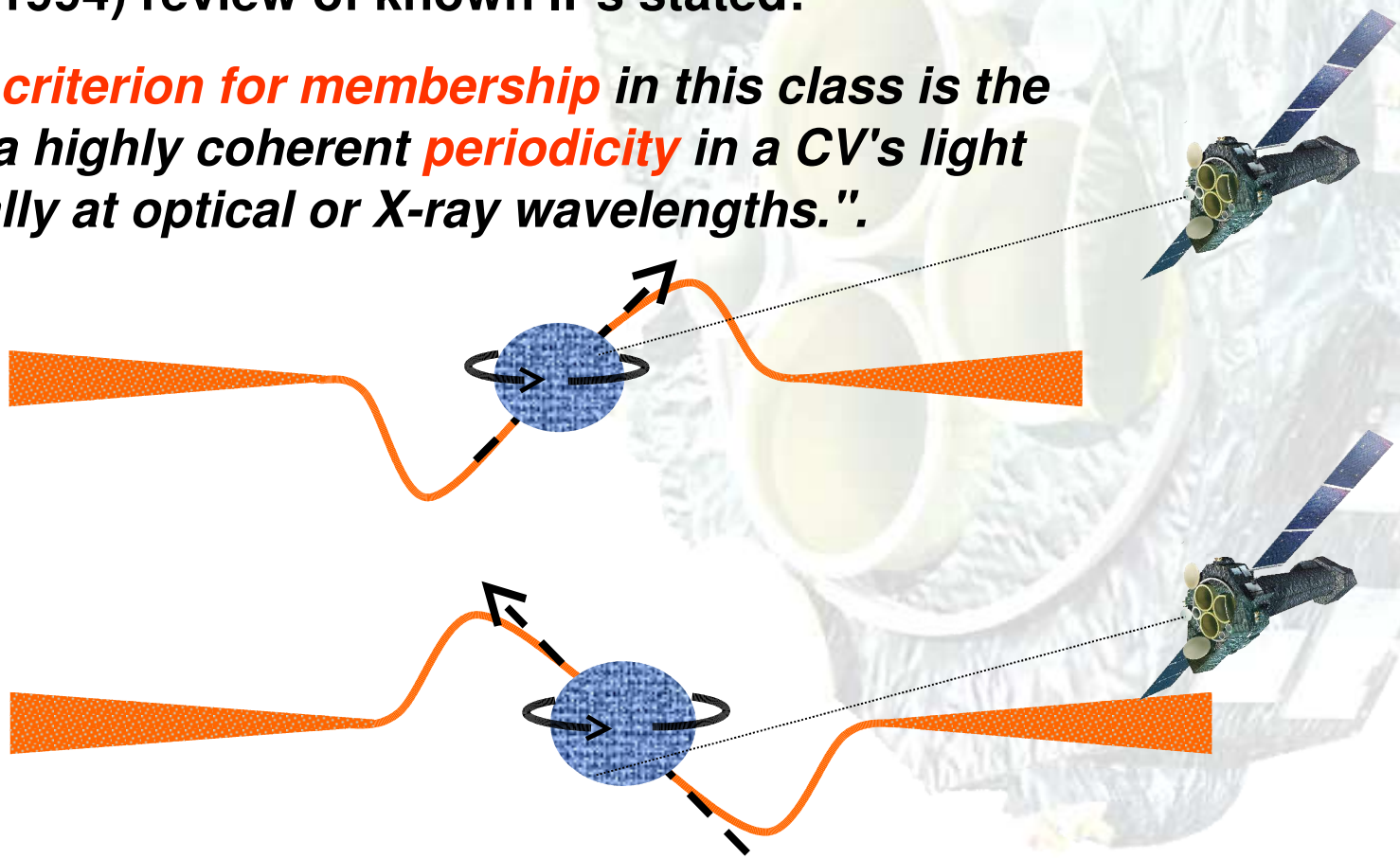
Intermediate Polars

Patterson's (1994) review of known IPs stated:

``The basic criterion for membership in this class is the presence of a highly coherent periodicity in a CV's light curve, typically at optical or X-ray wavelengths.".



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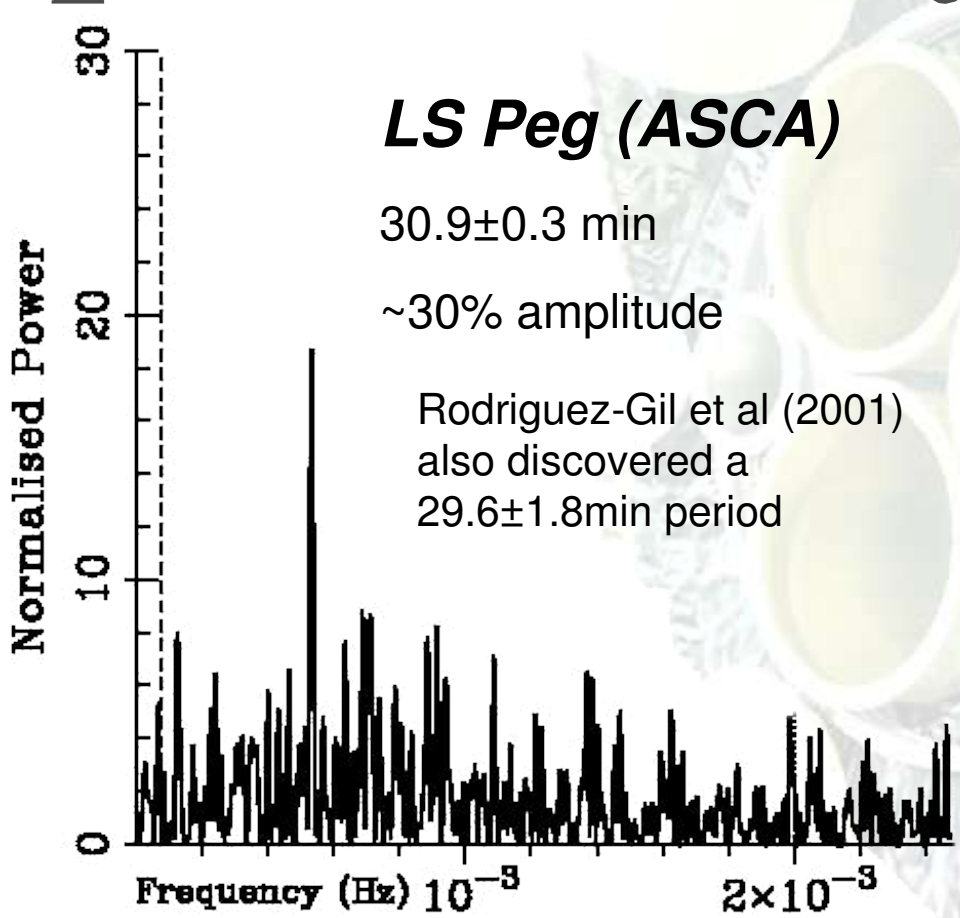
Temporal analysis



LS Peg (ASCA)

30.9±0.3 min

~30% amplitude

Rodriguez-Gil et al (2001) also discovered a 29.6±1.8min period

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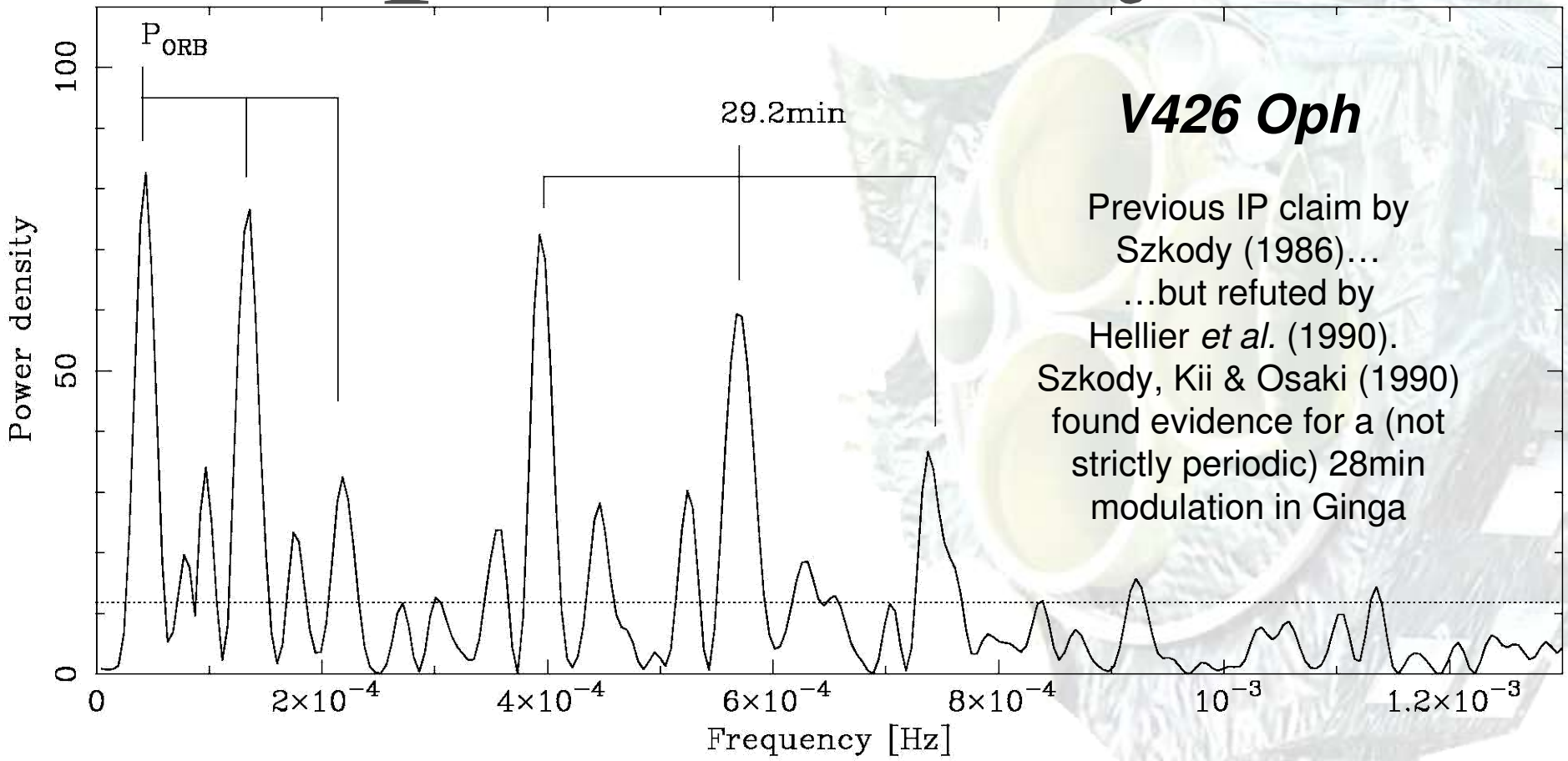
Temporal analysis



V426 Oph

Previous IP claim by Szkody (1986)…
…but refuted by Hellier *et al.* (1990).
Szkody, Kii & Osaki (1990) found evidence for a (not strictly periodic) 28min modulation in Ginga

ASCA

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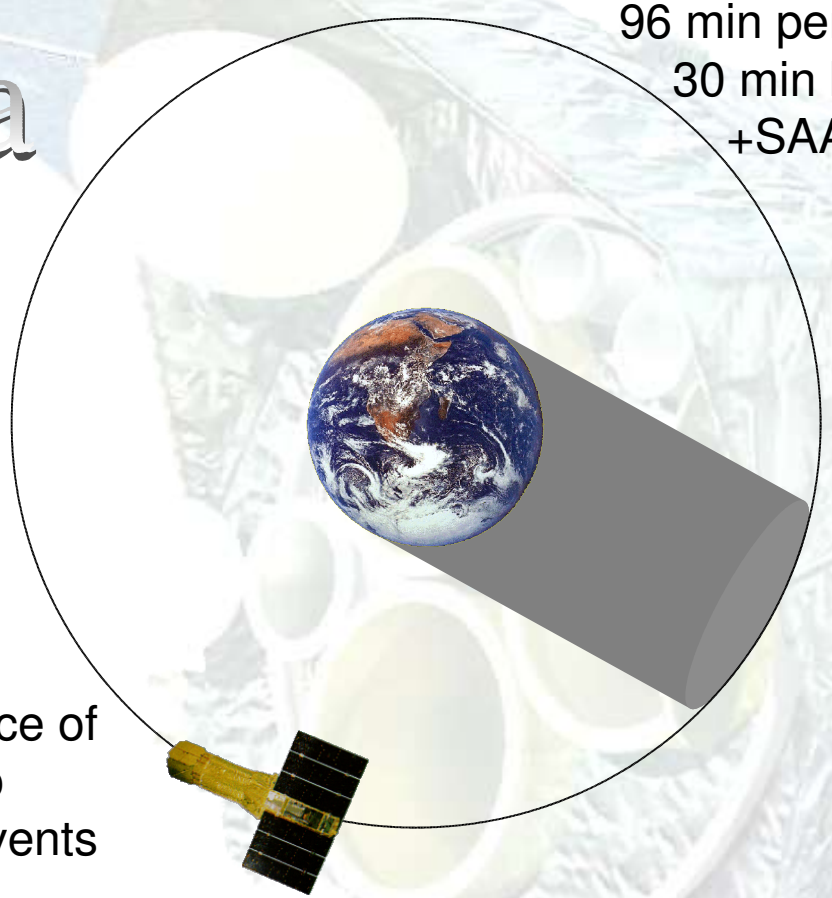
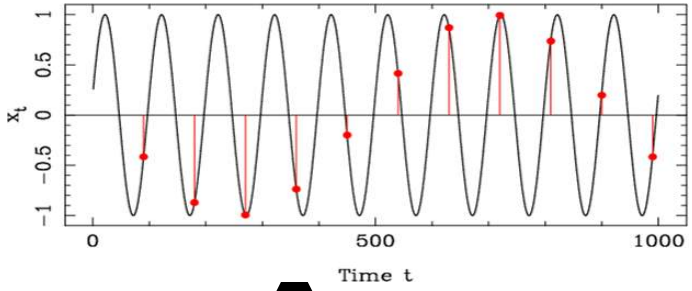
Power spectra

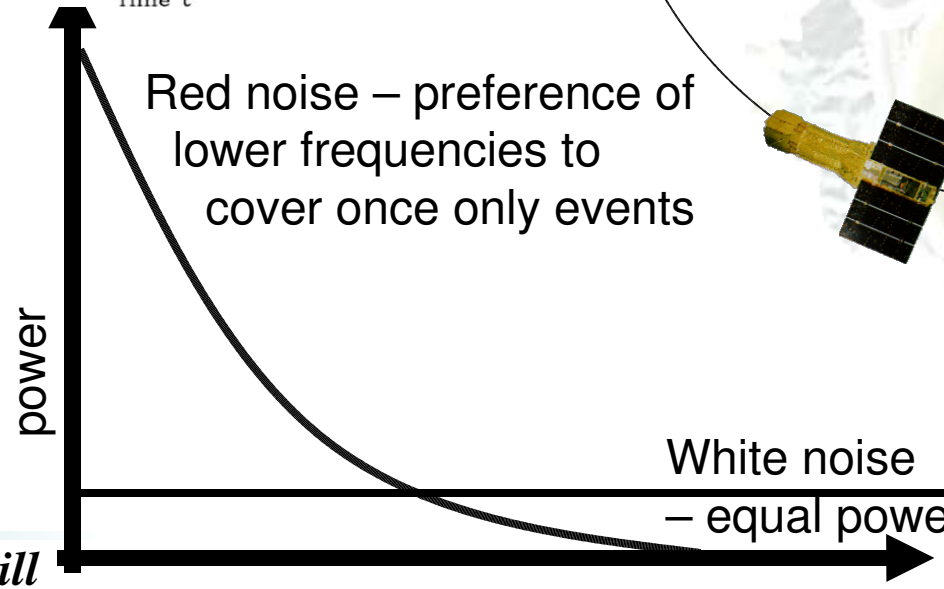
ASCA sampling problems caused by
96 min period,
30 min blind spot,
+SAA, etc



The problems: Aliasing caused by poor sampling



Red noise – preference of lower frequencies to cover once only events



White noise
– equal power at all frequencies

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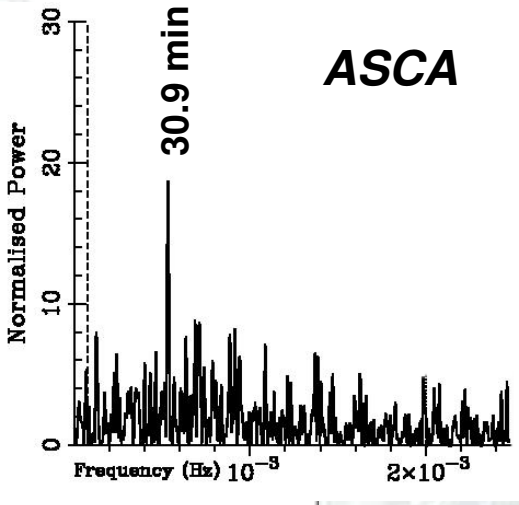
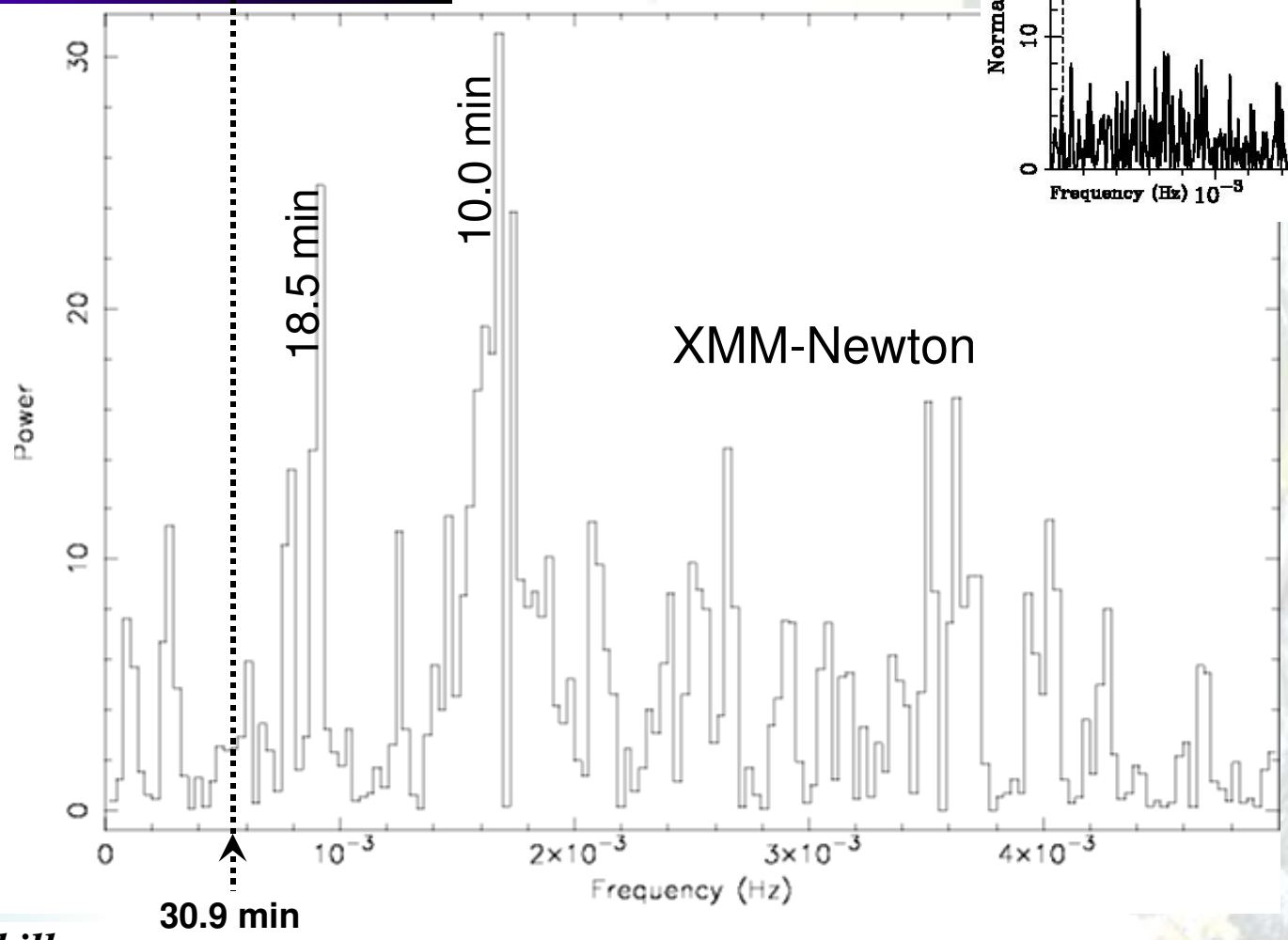
We got XMM-Newton time to observe both targets for ~30ks to resolve these issues

LS Peg
Temporal analysis





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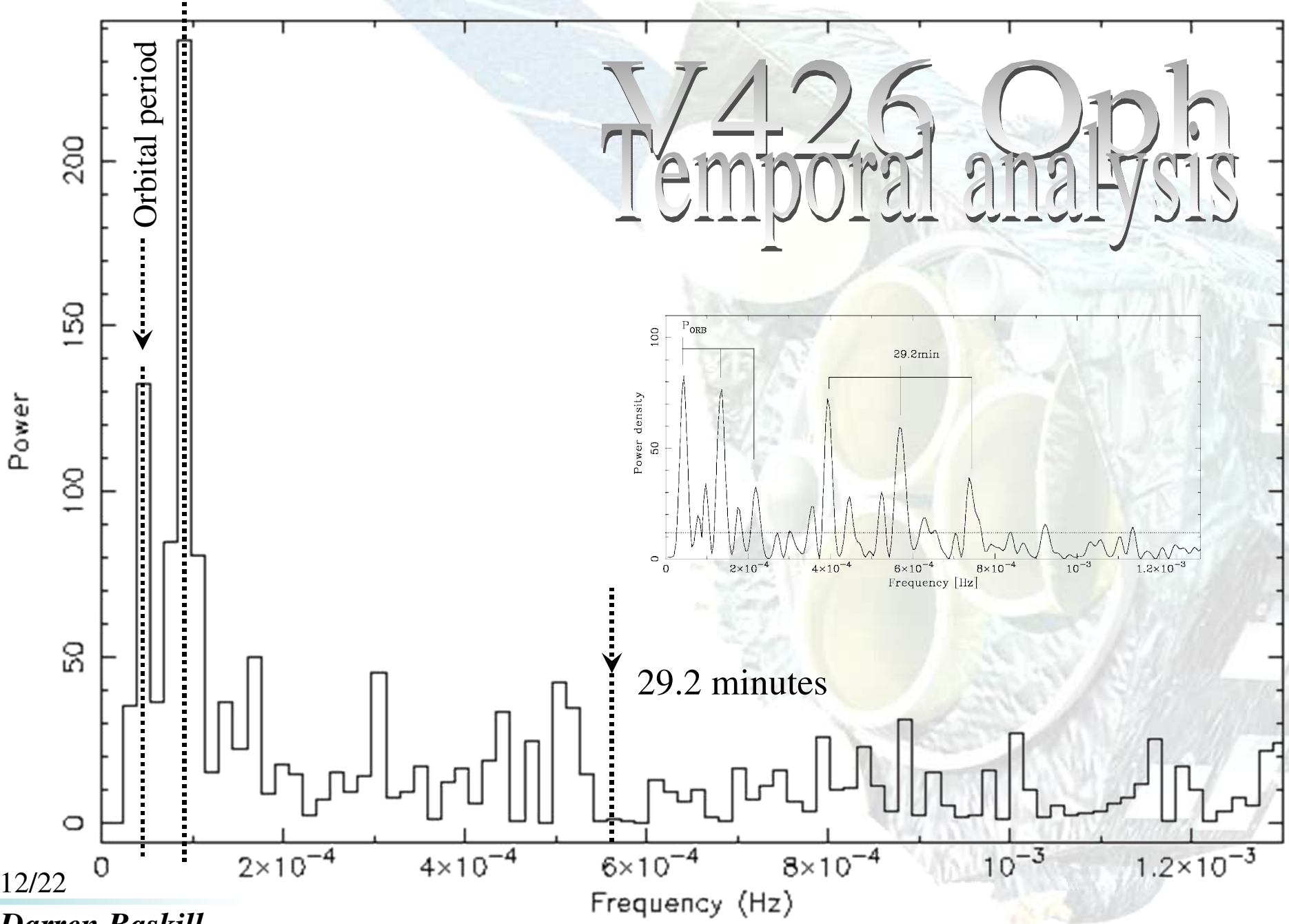
V426 Oph
Temporal analysis



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Temporal analysis

Results from the temporal analysis:

- No significant modulations

So these systems cannot be IP's…

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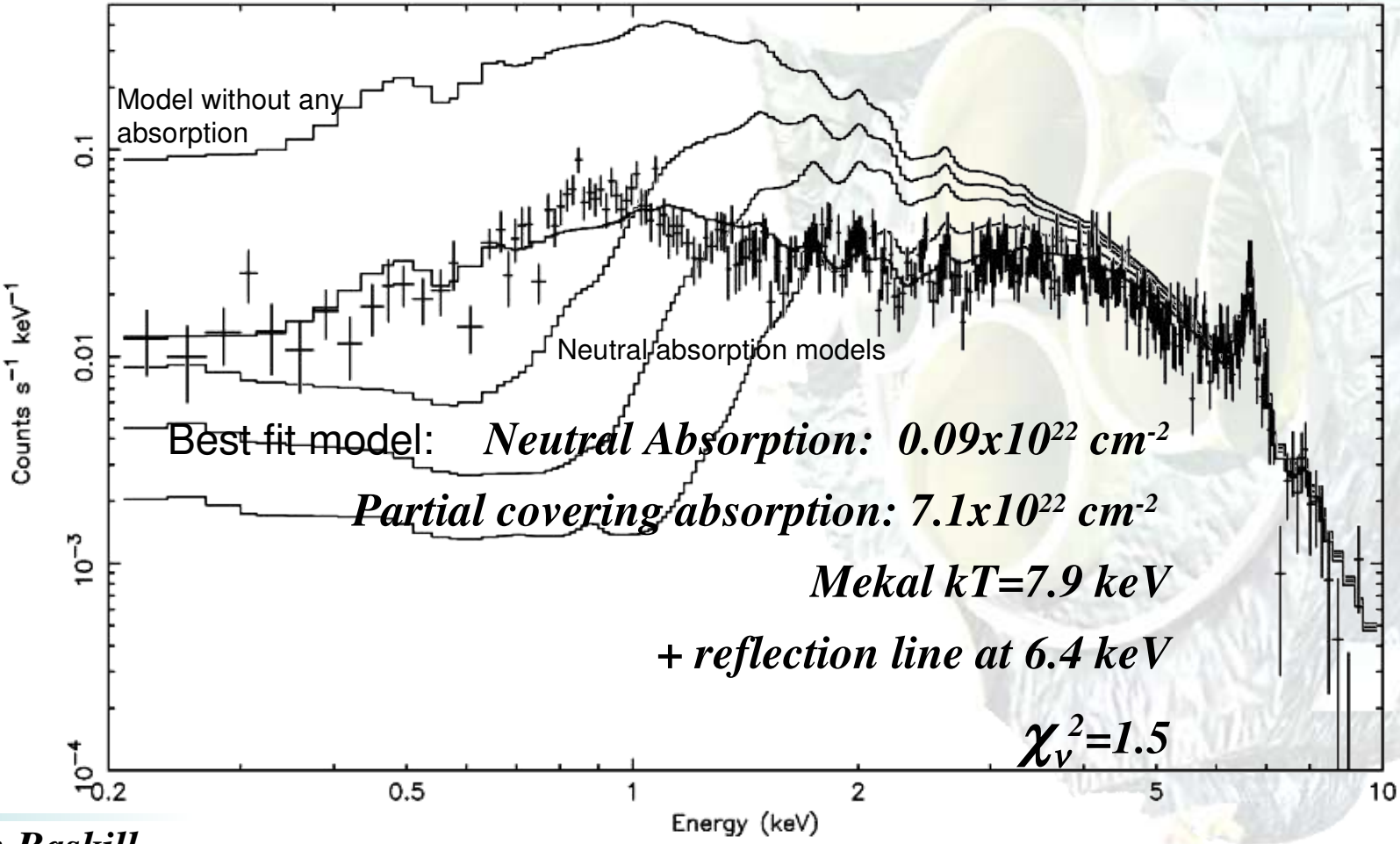
LS Peg
Spectral analysis



Best fit model: ***Neutral Absorption: 0.09x10^{22} cm^{-2}***

Partial covering absorption: 7.1x10^{22} cm^{-2}

Mekal kT=7.9 keV

+ reflection line at 6.4 keV

χ_ν^2=1.5

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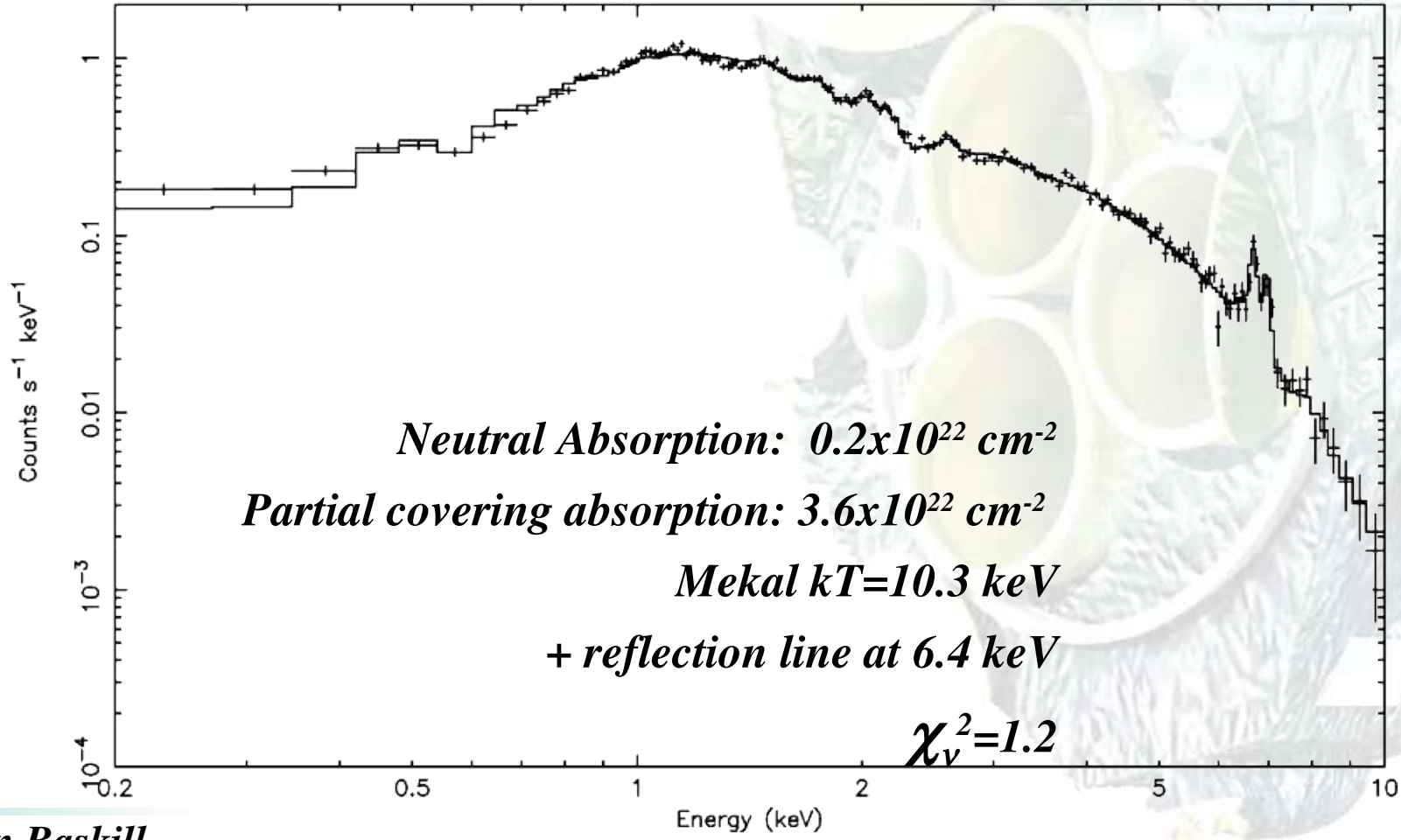
V426 Oph
Spectral analysis



Neutral Absorption: 0.2x10^{22} cm^{-2}

Partial covering absorption: 3.6x10^{22} cm^{-2}

Mekal kT=10.3 keV

+ reflection line at 6.4 keV

χ_ν^2=1.2

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Spectral analysis

Results from the spectral analysis…

- High amounts of intrinsic absorption

- Reflection signatures

… just like an intermediate polar

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Results

ASCA observed hard spectra, possible periods

Our aim with XMM-Newton was to see a hard spectra AND a periodic modulation… to confirm the IP nature of these systems.

However… XMM observed a hard spectra… but absolutely no periodic modulation!

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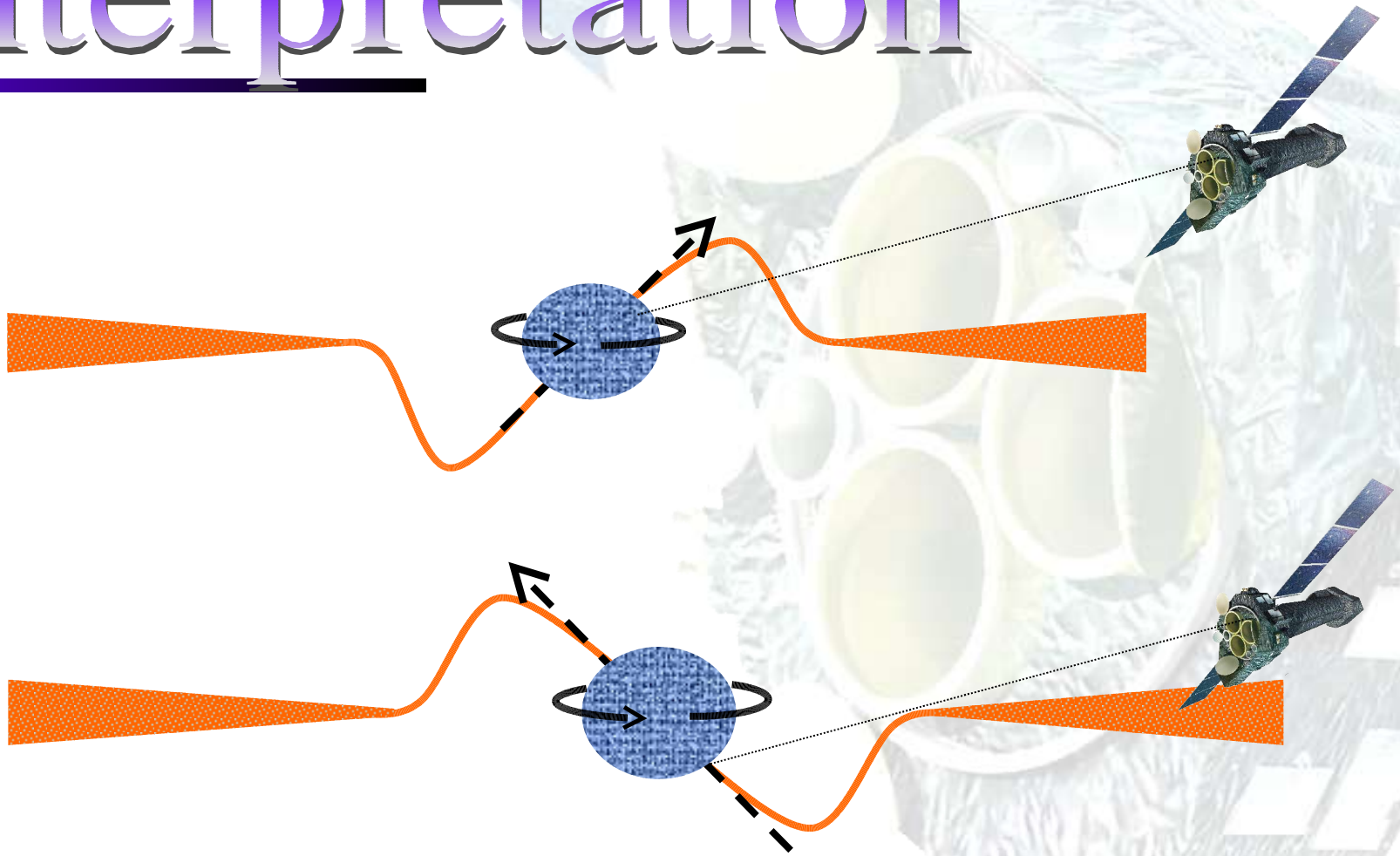
Interpretation



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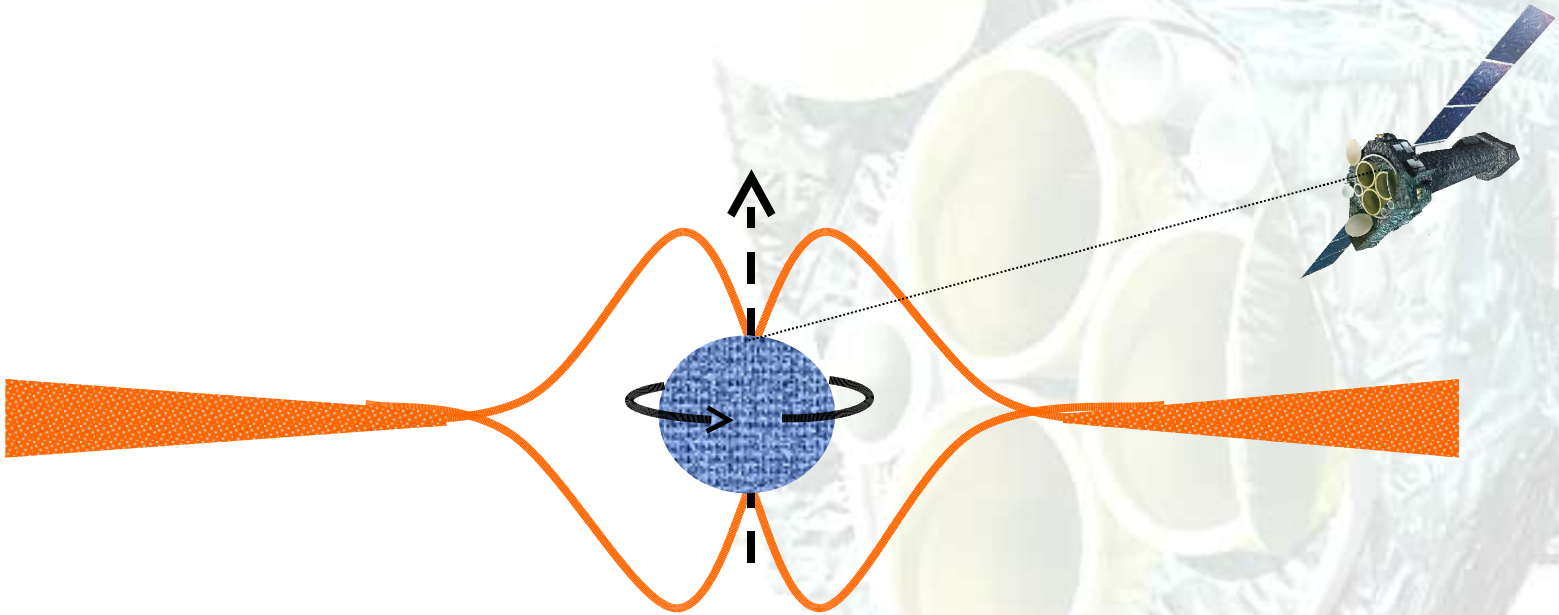
Interpretation



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Conclusion

- Previously, CV's were only accepted as magnetic if a coherent modulation was observed.

- We have discovered a new sub-set of "hidden" intermediate polars, that show no such modulation.

- This should be kept in mind, especially for galactic surveys… (e.g. the 2XMMp catalogue!)

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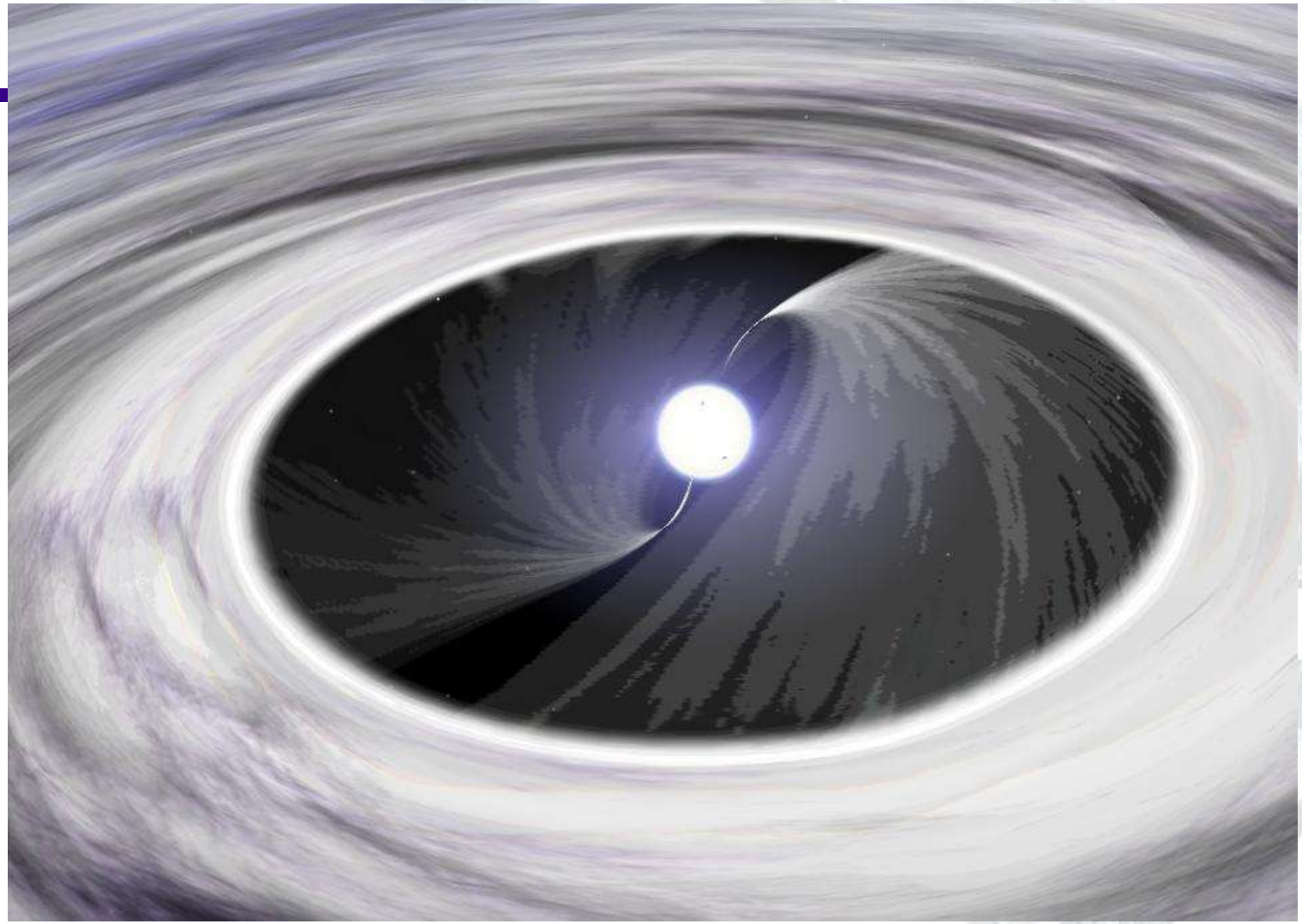
Intermediate Polars

The standard picture of an IP, allowing observation of both a IP like spectra and a strong modulation



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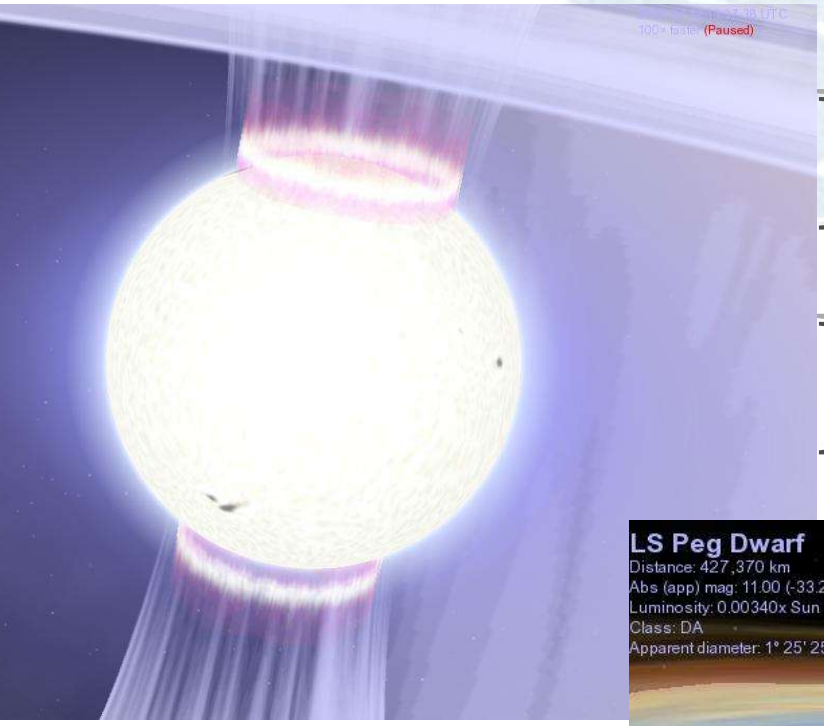
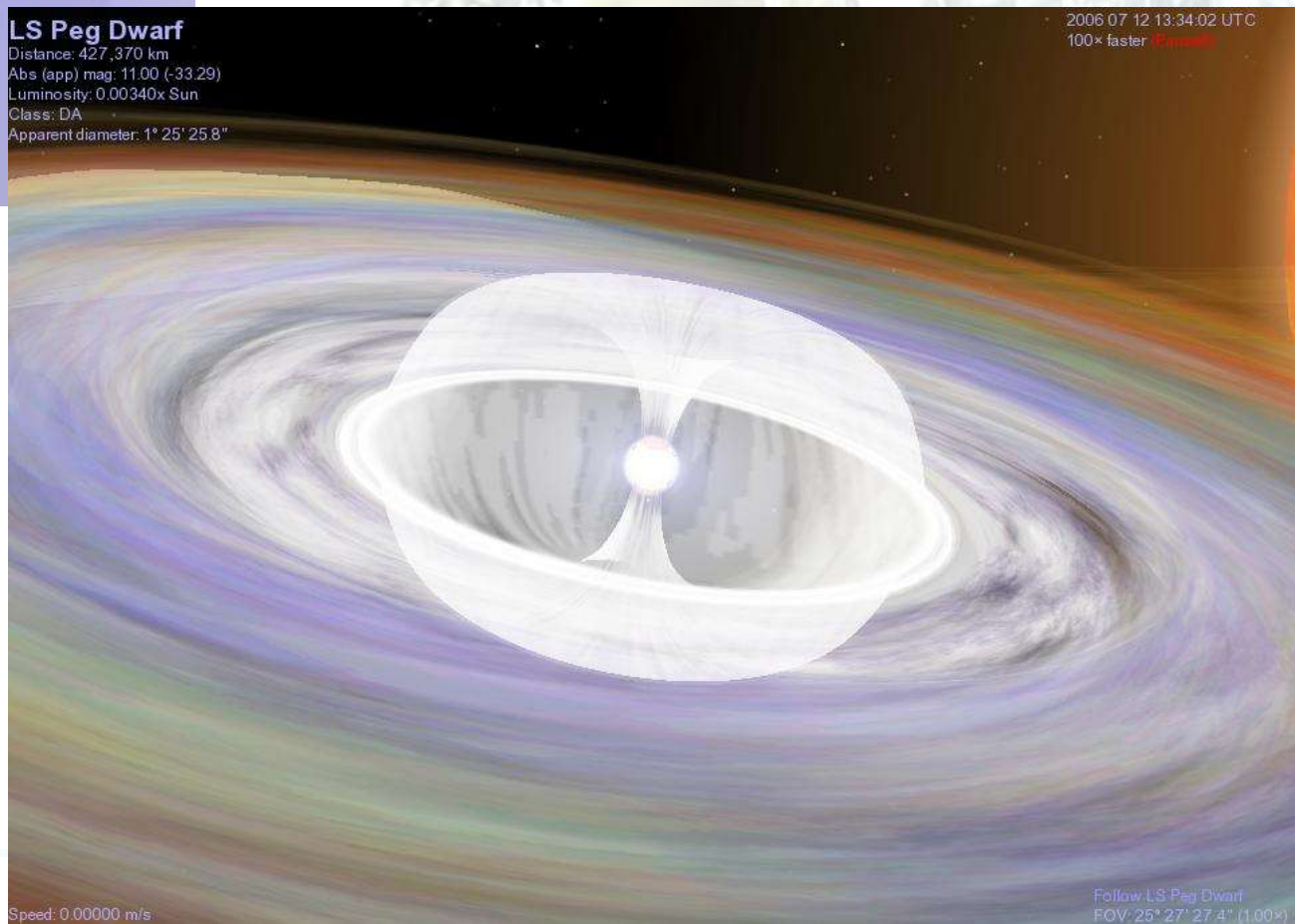
Visualisation by Chris Moran & myself using Celestia

Intermediate Polars





Above: the white dwarf at the centre of LS Peg

Right: symmetrical accretion flow on the white dwarf in LS Peg, allowing a IP spectra with no modulation

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