# Broad band spectra of magnetic white dwarfs- clue for accurate measurements of the WD masses

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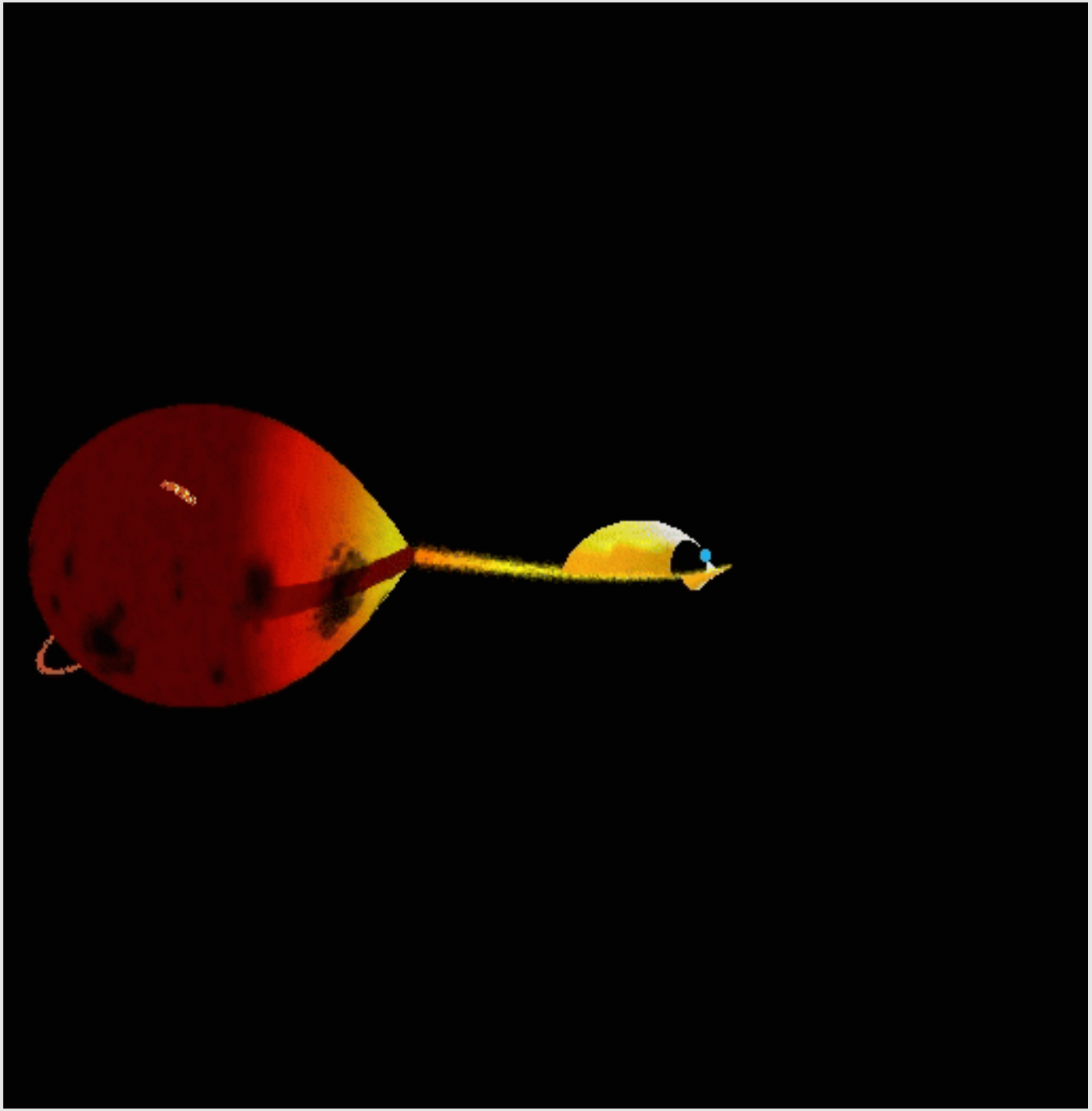
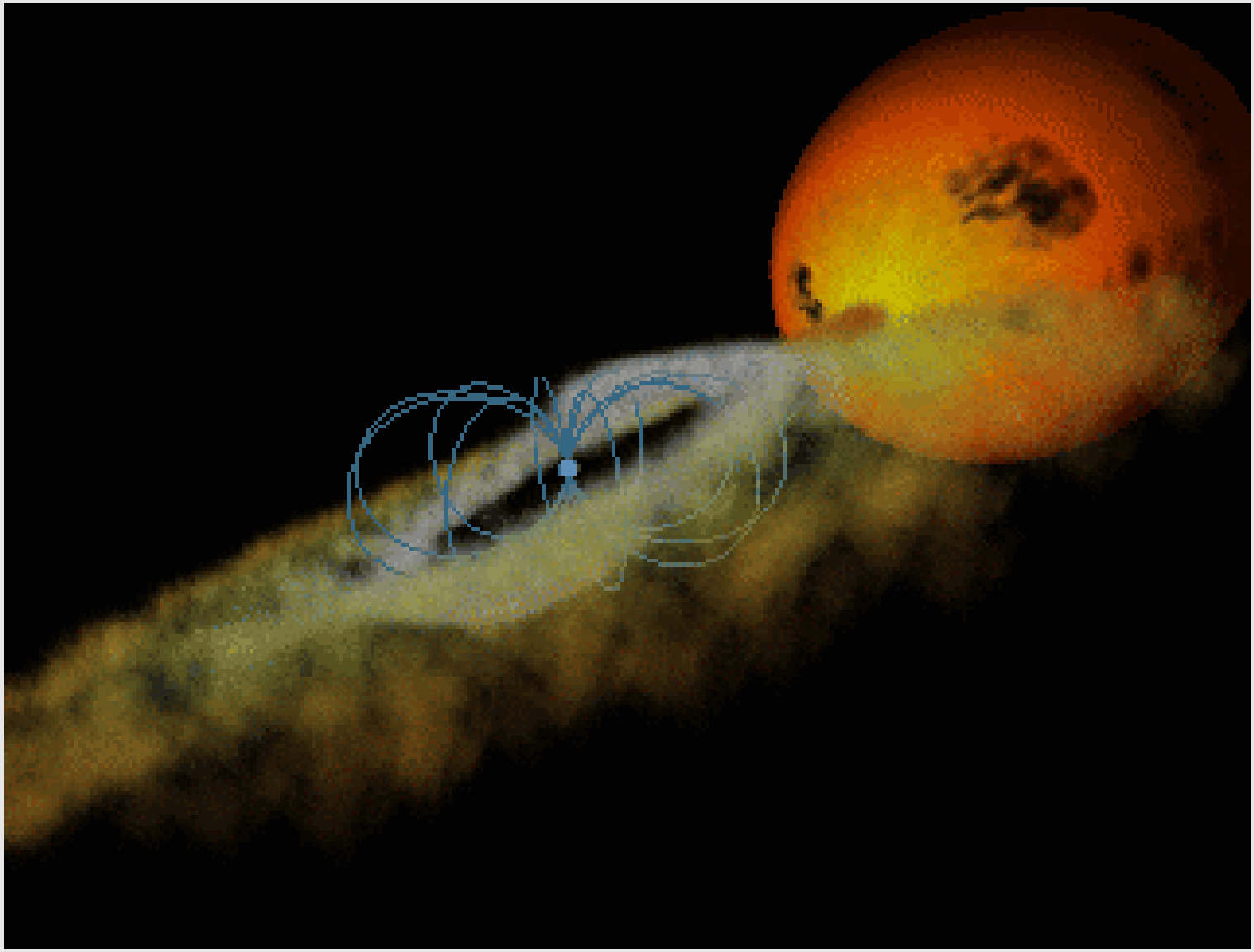
# Polars - magnetic white dwarfs



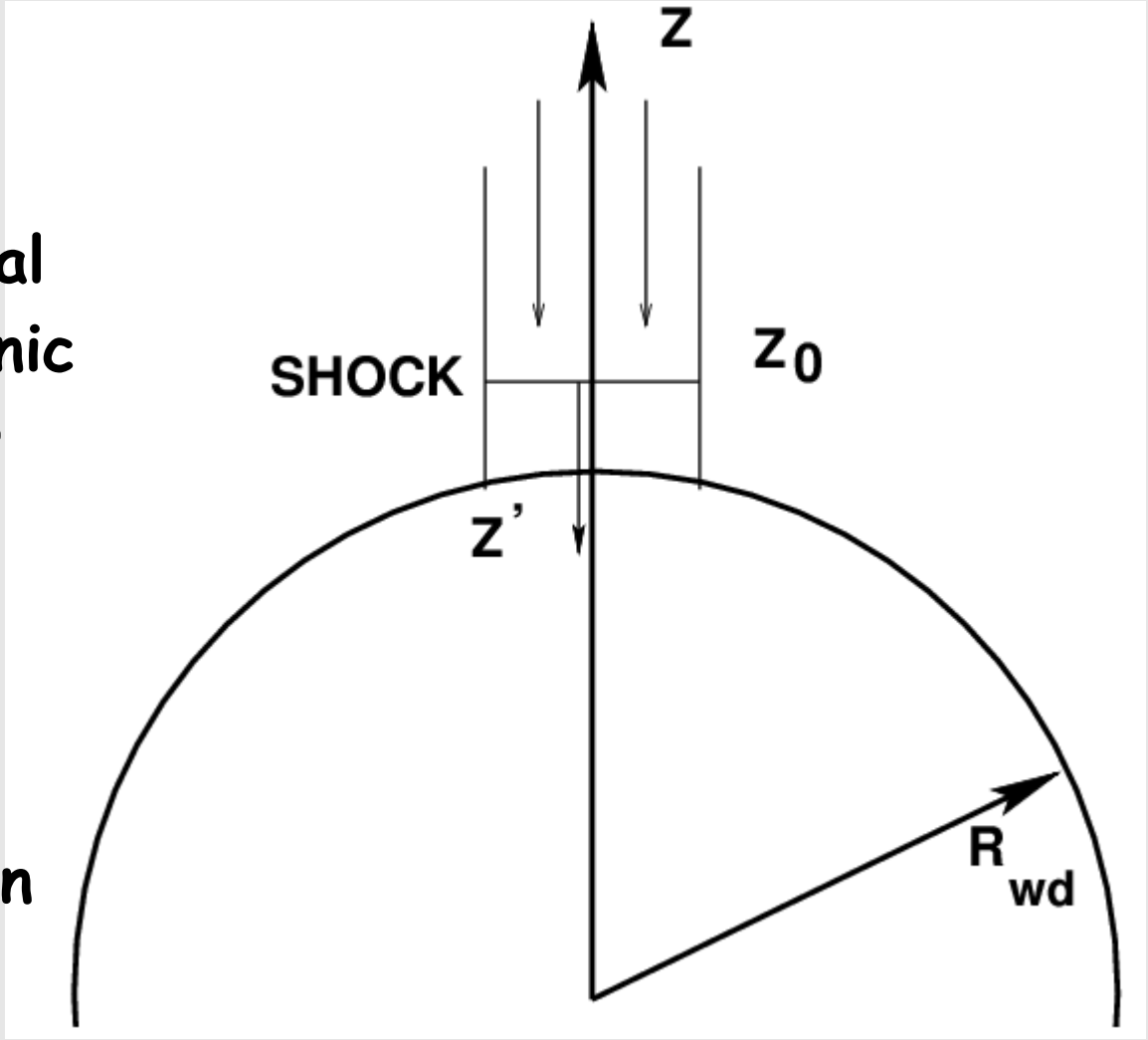
# Intermediate polars – do have acretion disks



1) Matter is collected to the polar caps

2) Total kinetic to thermal energy conversion. Subsonic settlement of the matter to the WD surface

3) Optically thin plasma emission. In the case of polars – cyclotron emission also can be important



$$\frac{d}{dz}(\rho v) = 0,$$

the momentum equation

$$\frac{d}{dz}(\rho v^2 + P) = -\frac{GM_{wd}}{z^2}\rho,$$

the energy equation

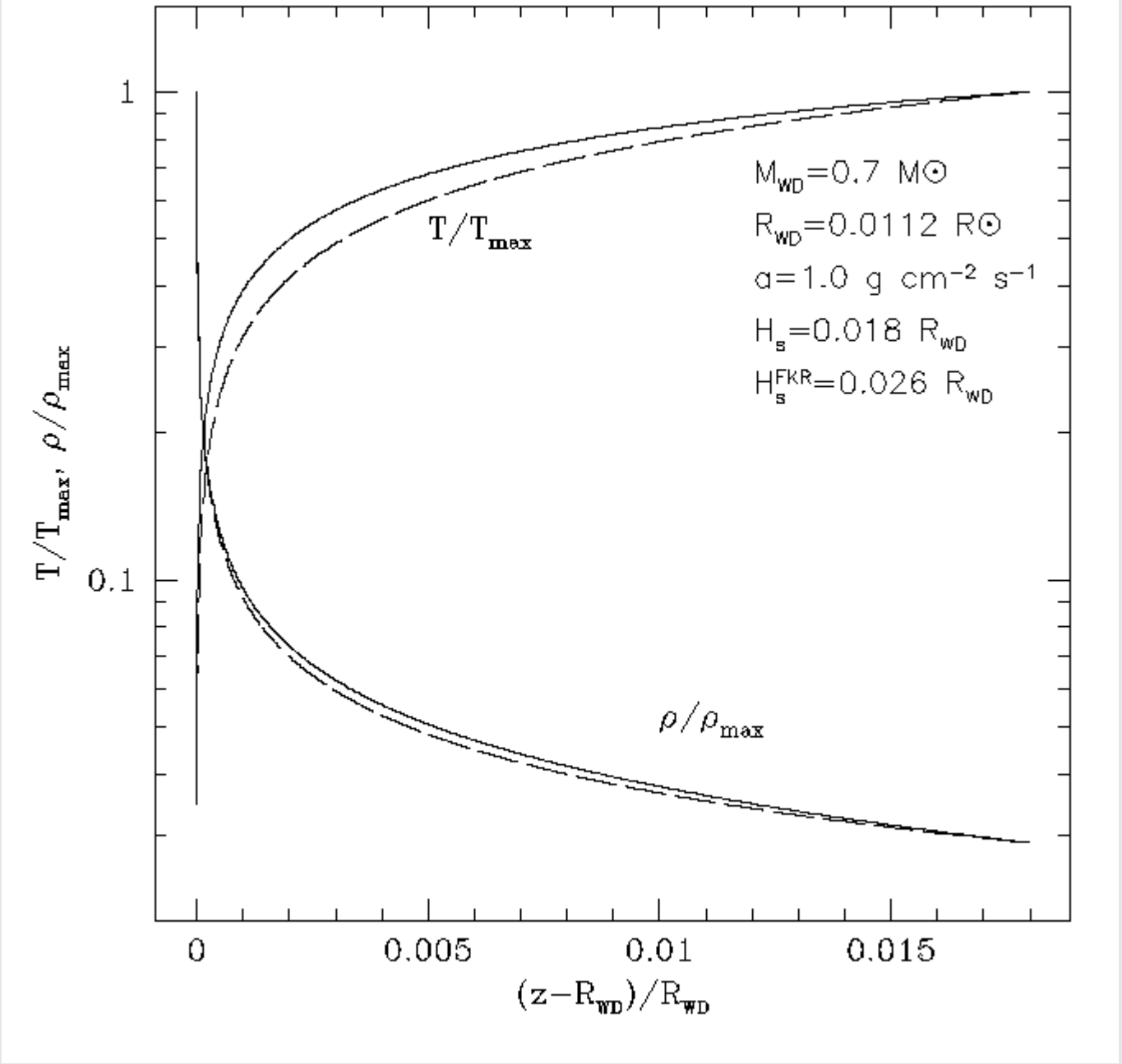
$$v\frac{dP}{dz} + \gamma P\frac{dv}{dz} = -(\gamma - 1)\Lambda,$$

and the ideal-gas law

$$P = \frac{\rho kT}{\mu m_H}.$$

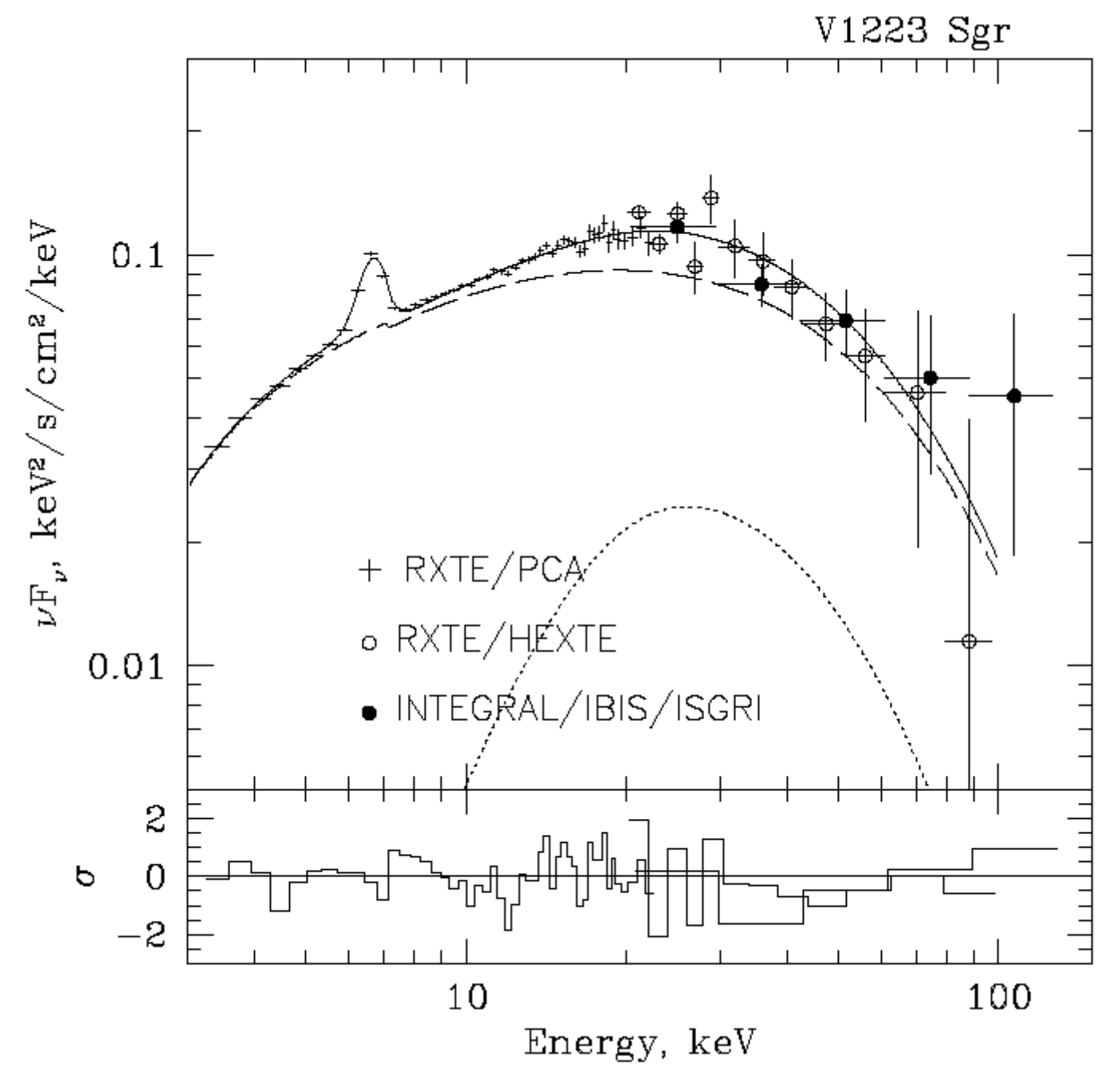
Simple equations provide us the temperature and density profiles.

Emission spectrum can be calculated

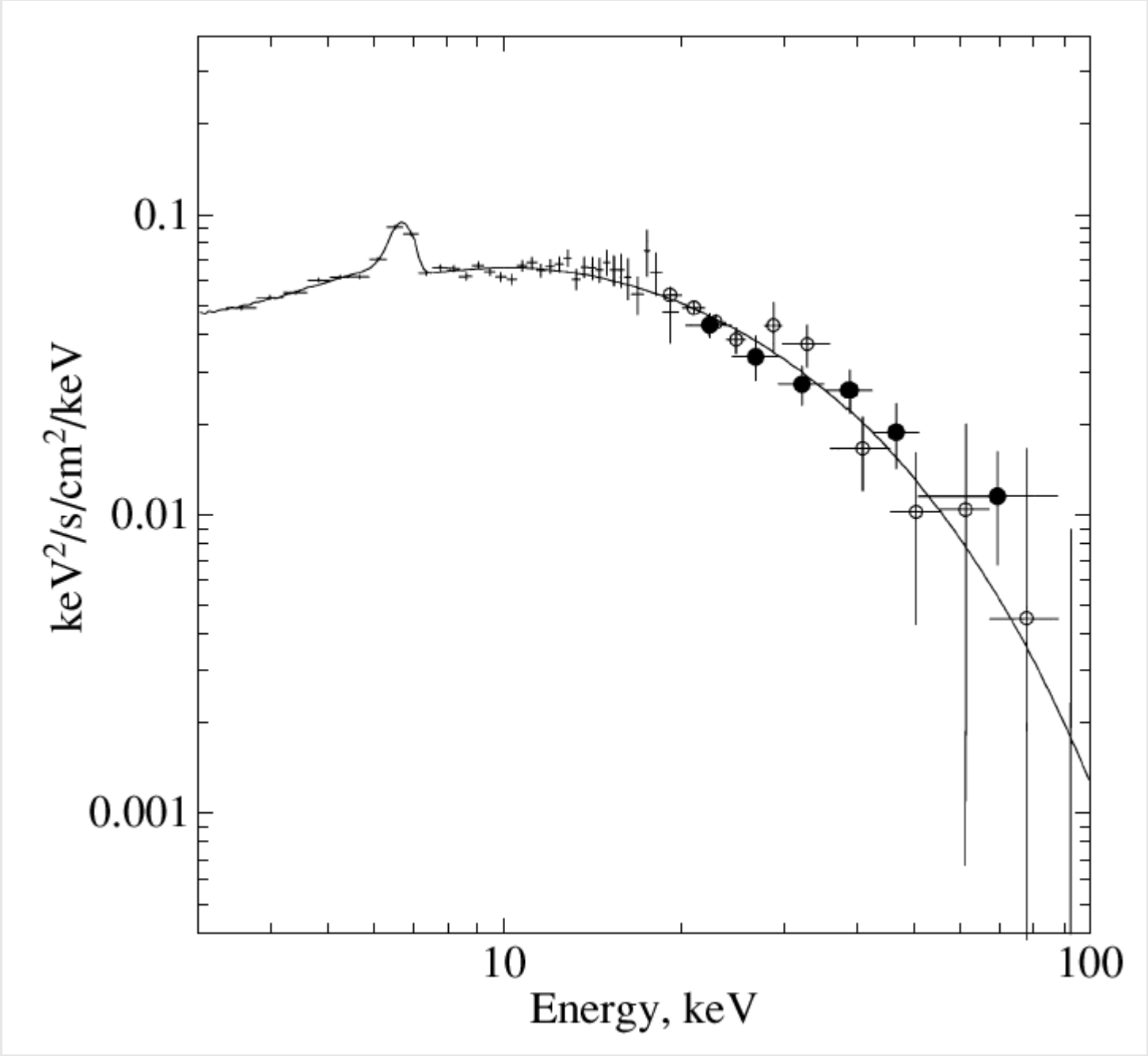



**Typical temperatures are ~10-20 keV. Hard X-rays are needed!**

# V1223 Sgr


V1223 Sgr
0.1
0.01
$\nu F_\nu$, keV²/s/cm²/keV
+ RXTE/PCA
o RXTE/HEXTE
● INTEGRAL/IBIS/ISGRI
2
0
−2
σ
10
100
Energy, keV

# V2400 Oph

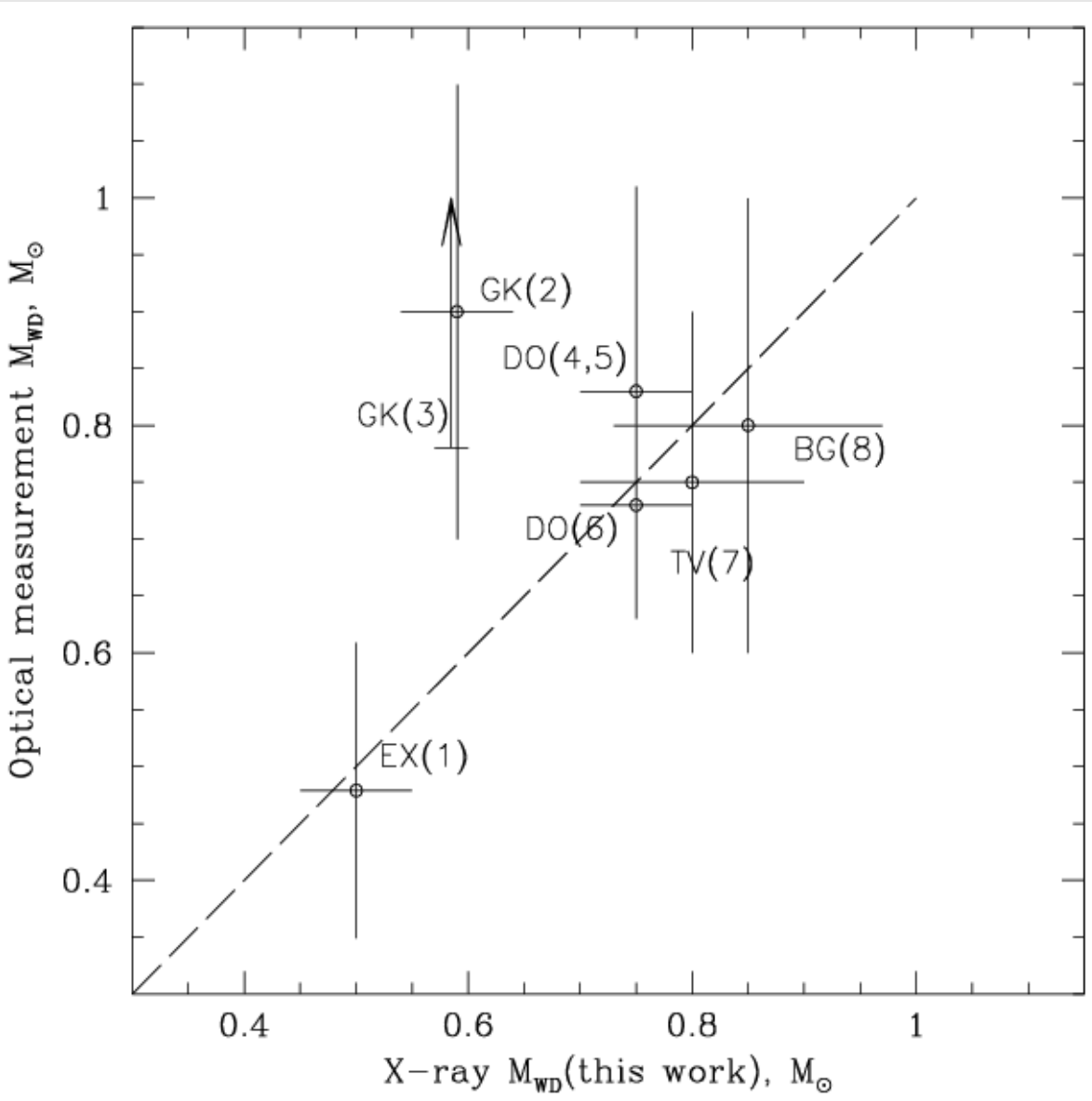


| Name | PCA+HEXTE | RXTE/PCA | Ginga | ASCA |
|---|---|---|---|---|
| | $M_\odot$ | $M_\odot$ | $M_\odot$ | $M_\odot$ |
| V1223 Sgr | 0.9 | 1.1 | | 1.28 |
| FO Aqr | 0.6 | 0.88 | 0.92 | 1.05 |
| EX Hya | 0.5 | 0.45 | 0.46 | 0.48 |
| AO Psc | 0.65 | 0.60 | 0.56 | 0.40 |
| TV Col | 0.84 | 0.96 | 1.30 | 0.51 |
| GK Per | 0.59 | | | 0.52 |
| V709 Cas | 0.9 | 1.08 | | |
| PQ Gem | 0.65 | | | |
| V2400 Oph | 0.59 | 0.71 | | 0.68 |
| BG CMi | 0.85 | 1.20 | 1.09 | |
| V405 Aur | 0.9 | 1.10 | | >0.54 |
| V1062 Tau | 1.0 | 0.90 | | |
| DO Dra | 0.75 | | | |
| TX Col | 0.7 | 0.73 | 0.48 | 0.66 |

Masses determined from broad band spectra differ from narrow band estimates

Broad band data are more reliable

## Extension of INTEGRAL database - RXTE observations



# Summary

1) Standard X-ray energy band is not sufficient for reliable mass estimates of magnetic white dwarfs

2) Broad band measurements (1-100 keV) are important

3) INTEGRAL already provided low noise spectra of 2 intermediate polars. Let us wait to get more

**Papers: Revnivtsev et al. 2004, A&A (V1223 Sgr)**
**Revnivtsev et al. 2004, Astr.Lett (V2400 Oph)**
**Suleimanov et al. 2005, A&A accepted (8 I.Polars)**