Eclipsing the X–ray emitting regions in AGN

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In collaboration with:

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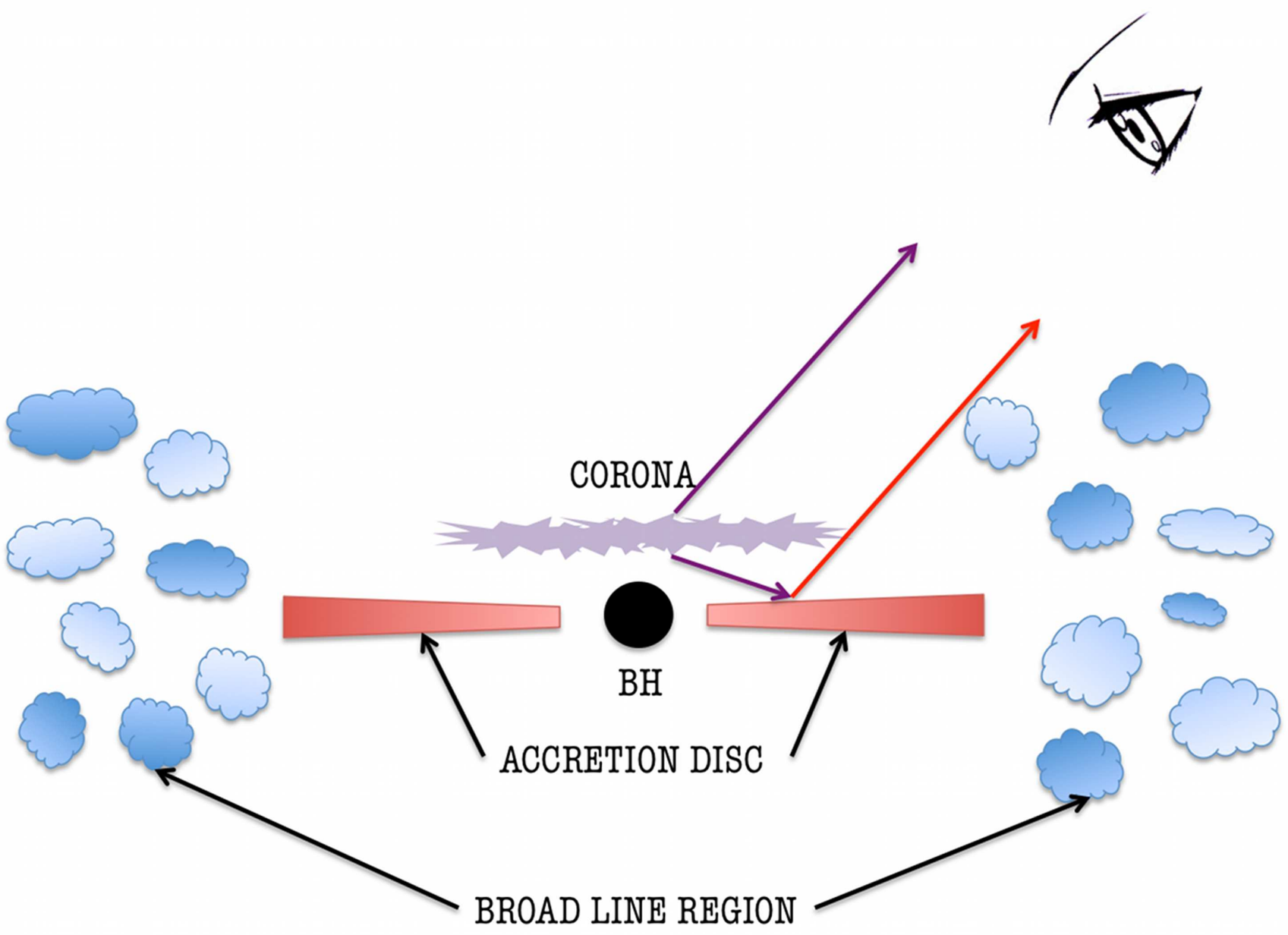
Sledging down the Black Hole potential well – Sesto / Sexten, July 13, 2015

STRONGGRAVITY
EU FP7-SPACE research project 312789 2013 - 2017

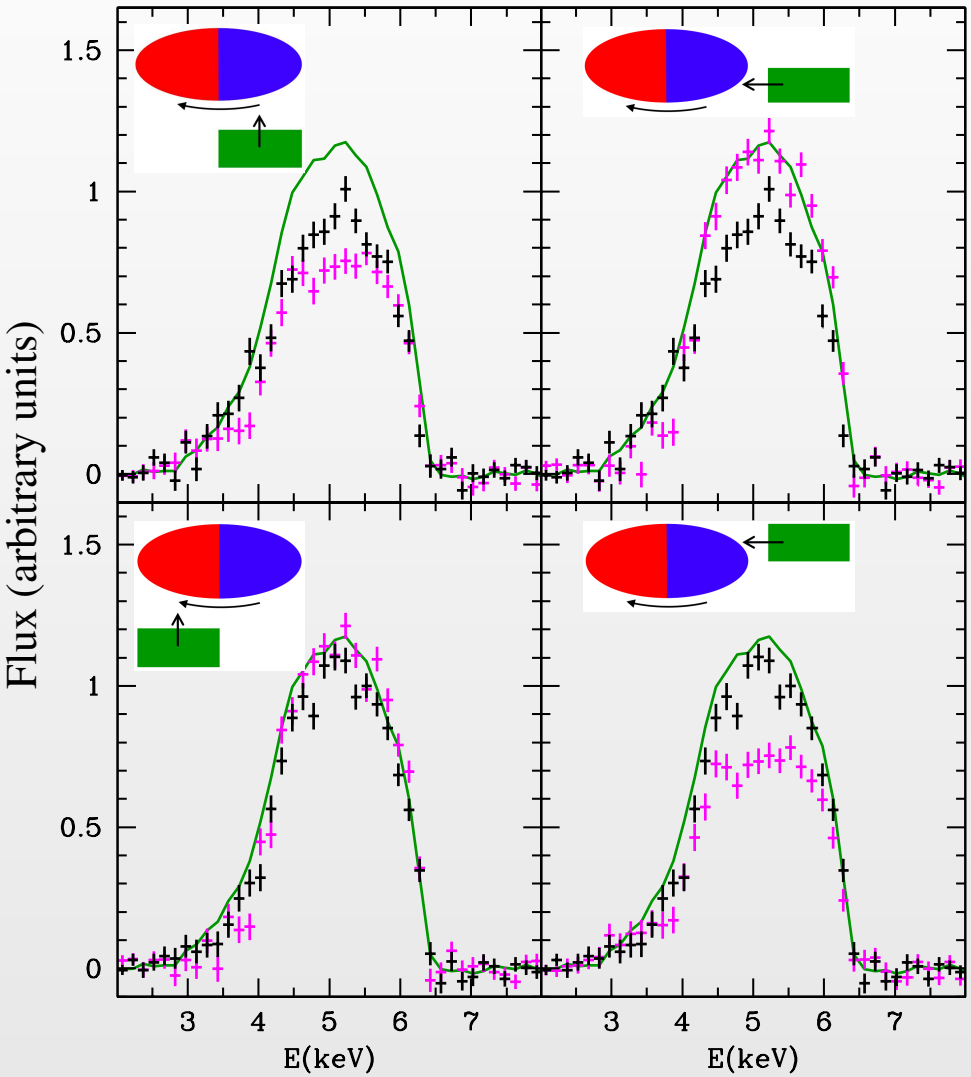
SEVENTH FRAMEWORK PROGRAMME

The innermost regions in AGN: general scheme



Motivation

To probe general relativistic effects by studing X–ray eclipses



NGC1365

Risaliti et al. +11

(MNRAS 417, 178–183)

Compton–thin cloud

$N_{\rm H} = 3.5 \times 10^{23} {\rm cm}^{-2}$

$A_{\rm eff} = 2\,{\rm m}^2$ @ 6 keV

The KYNCONV model: intro

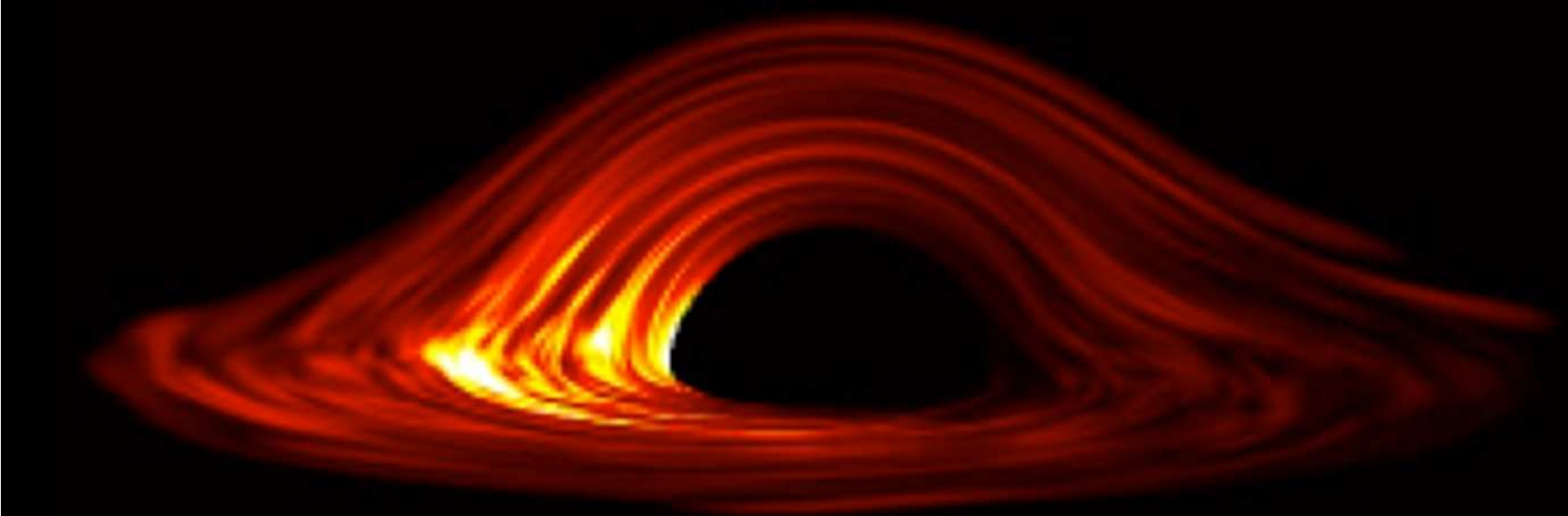
Set of KY relativistic models in Dovčiak et al. +04 (ApJS 153, 205–221)

relativistic convolution model

accretion discs spectra

strong gravity regime

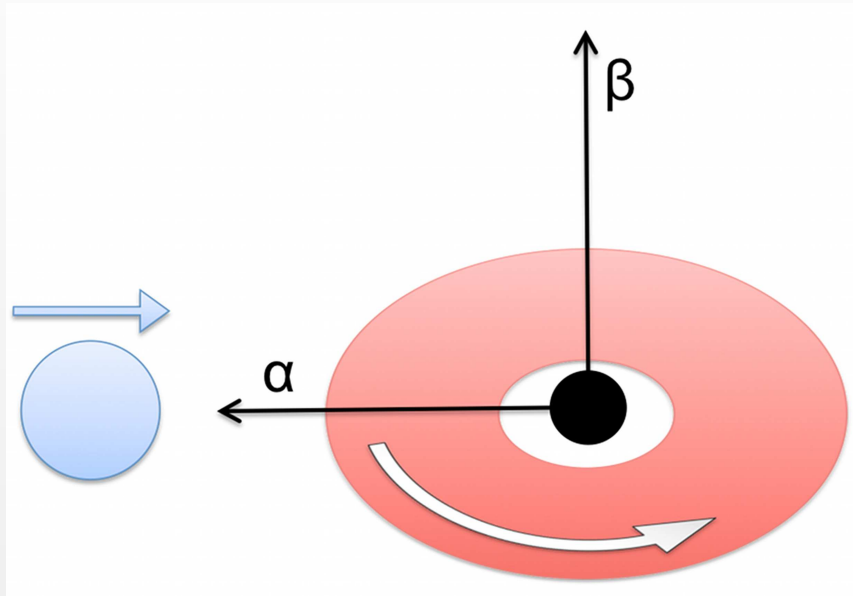
obscuration with a circular cloud



The KYNCONV model: main parameters

System inclination $\rightarrow \theta_0$ /deg

Central engine $\begin{cases} \text{BH spin} & \rightarrow & \text{a} \\ \text{emissivity index} & \rightarrow & \text{q} \end{cases}$

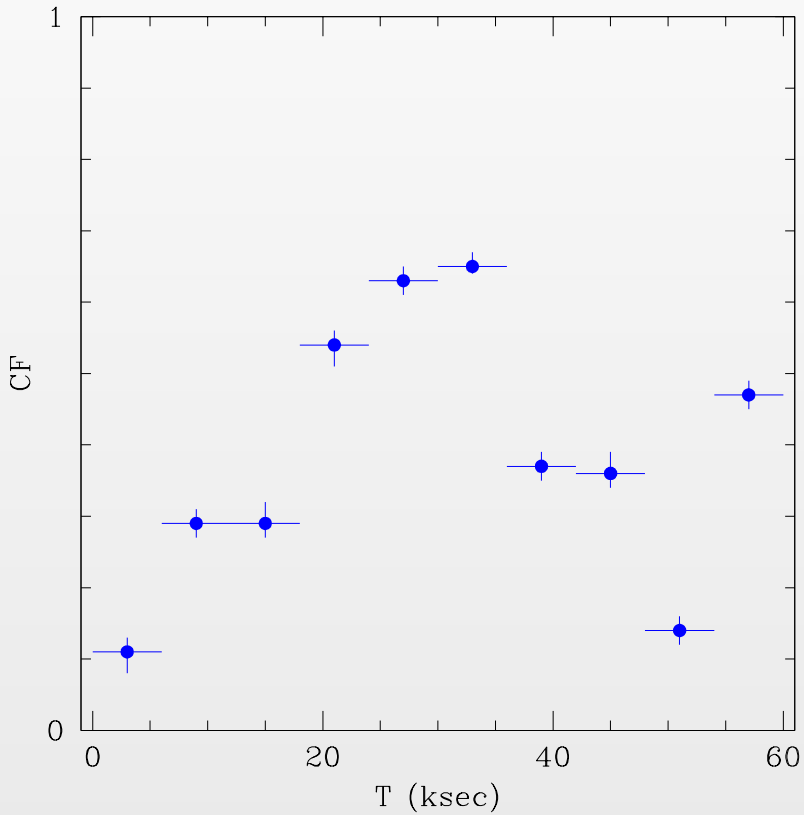


Cloud $\begin{cases} \text{position} & \rightarrow & \alpha, \beta \ / \frac{\text{GM}}{\text{c}^2} \\ \text{size} & \rightarrow & \text{r} \ / \frac{\text{GM}}{\text{c}^2} \\ \text{column density} & \rightarrow & N_{\text{H}} \ / \text{cm}^{-2} \ (\texttt{phabs, zxipcf}) \\ \text{ionisation} & \rightarrow & \log \xi, \text{ with } \xi \ / \frac{\text{erg cm}}{\text{s}} \ (\texttt{zxipcf}) \end{cases}$

What we could expect

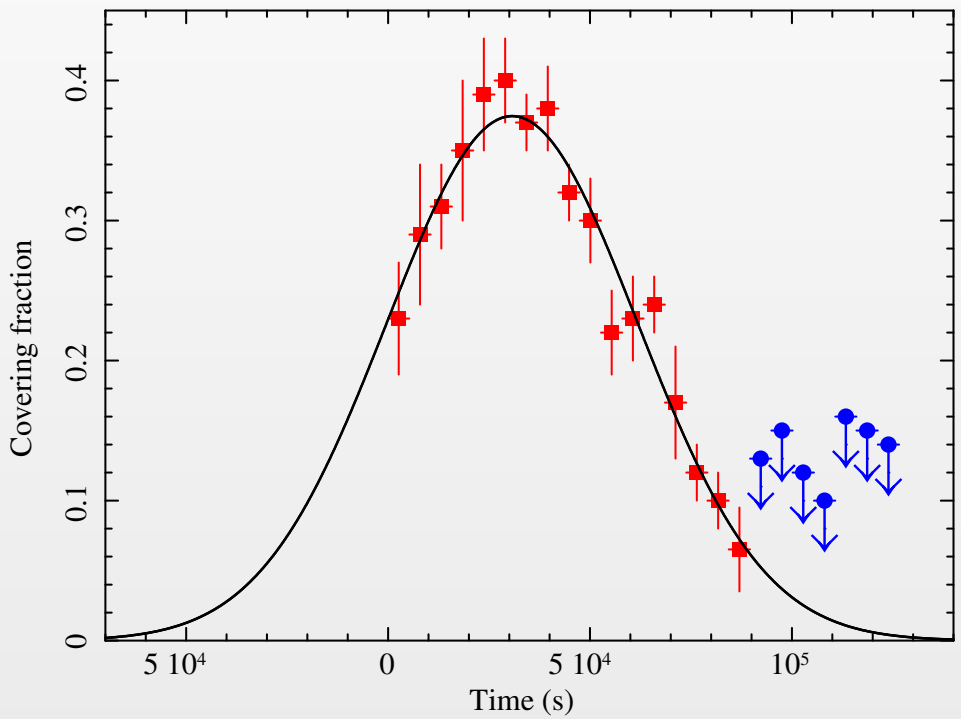
Previous detections of disc–emission anisotropies?

NGC1365



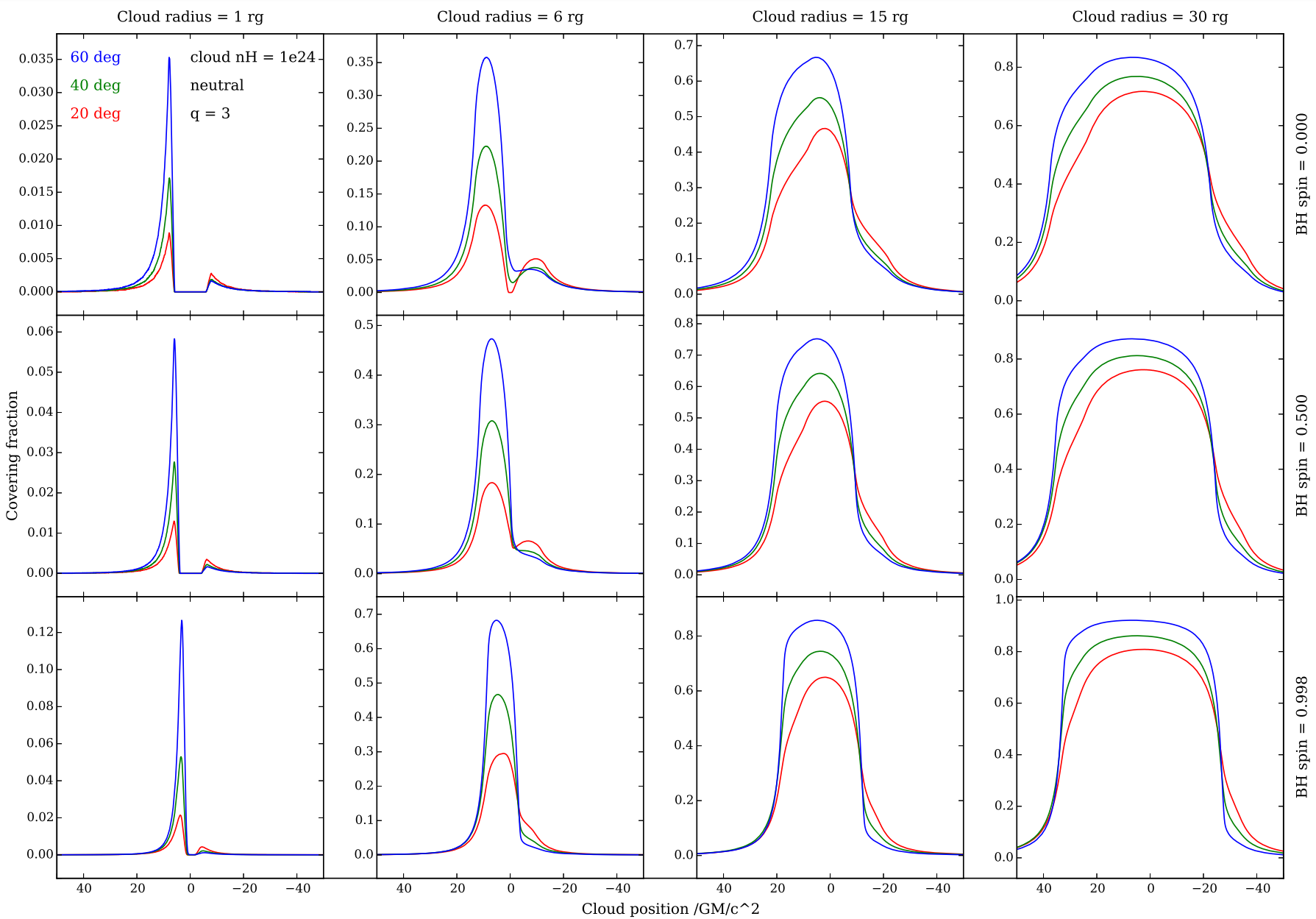
Risaliti et al. +09 (ApJ 696, 160–171)

SWIFT J2127.4+5654



Sanfrutos et al. +13 (MNRAS 436, 1588–1594)

The covering fraction profiles (I)



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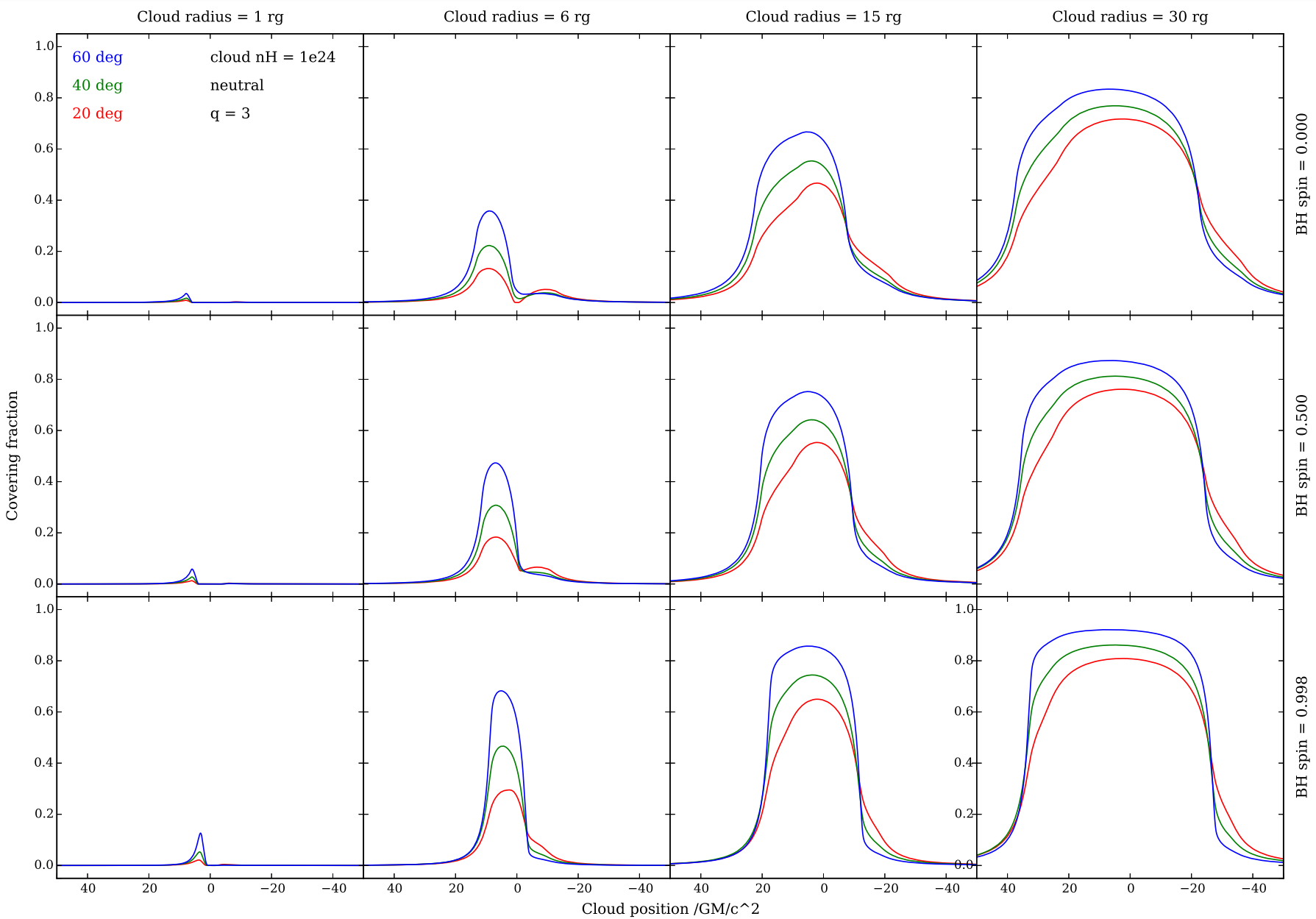
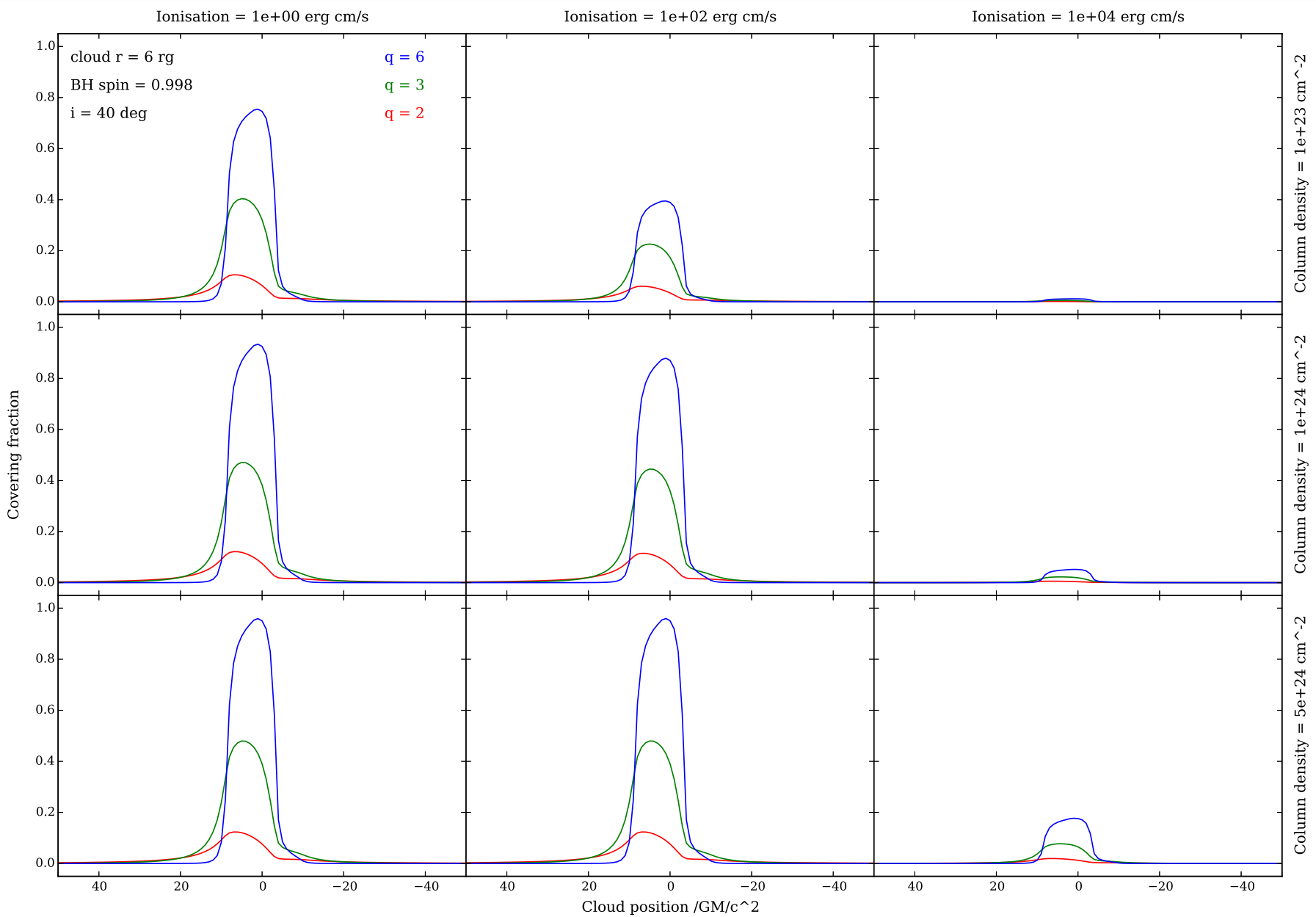
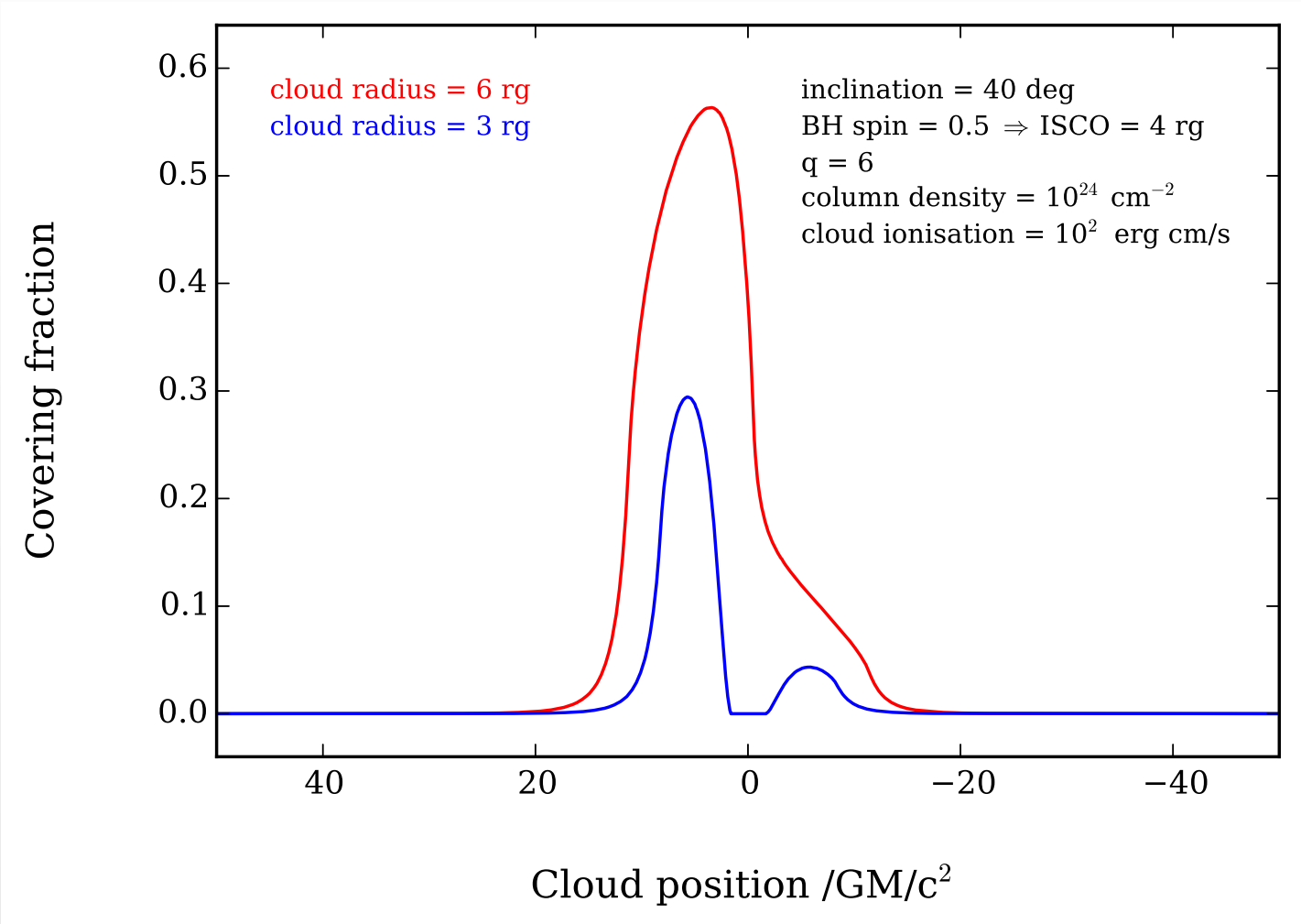


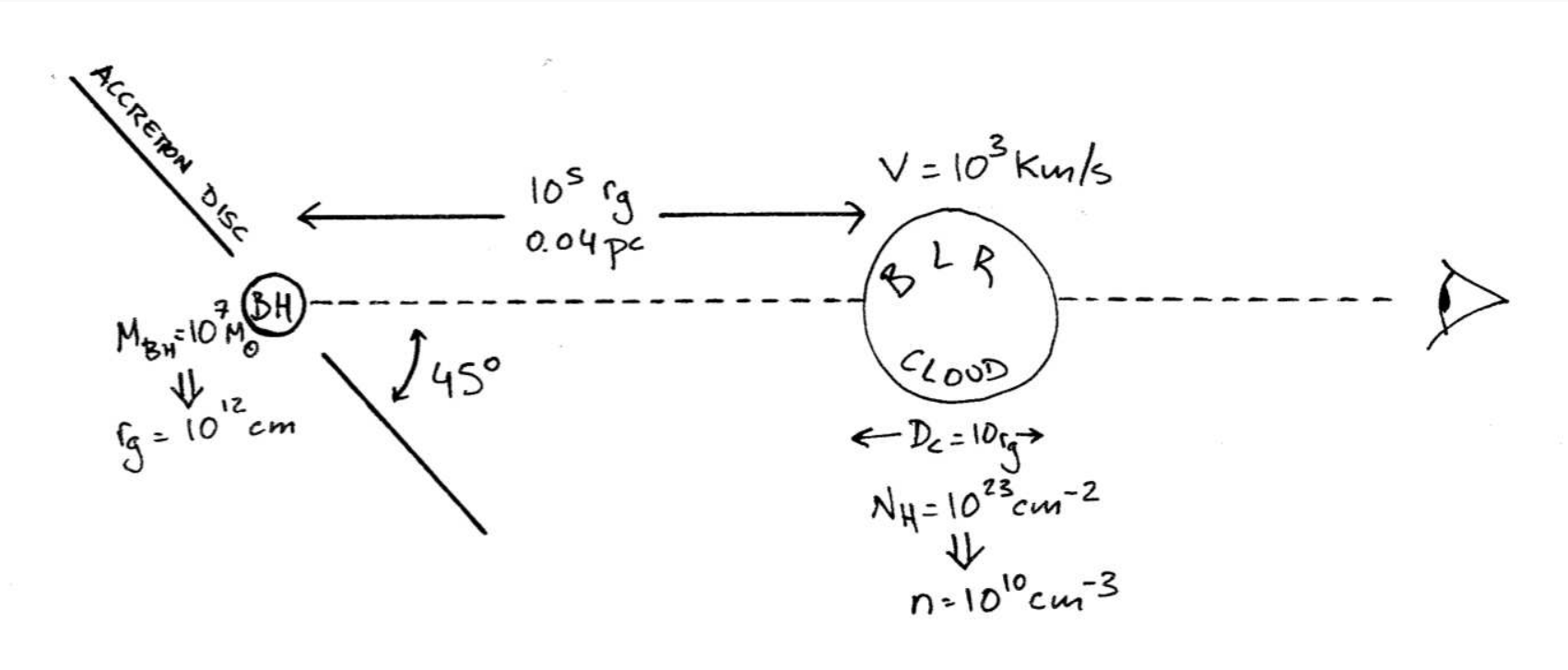
The covering fraction profiles (II)



The covering fraction profiles (III)



A plausible physical system



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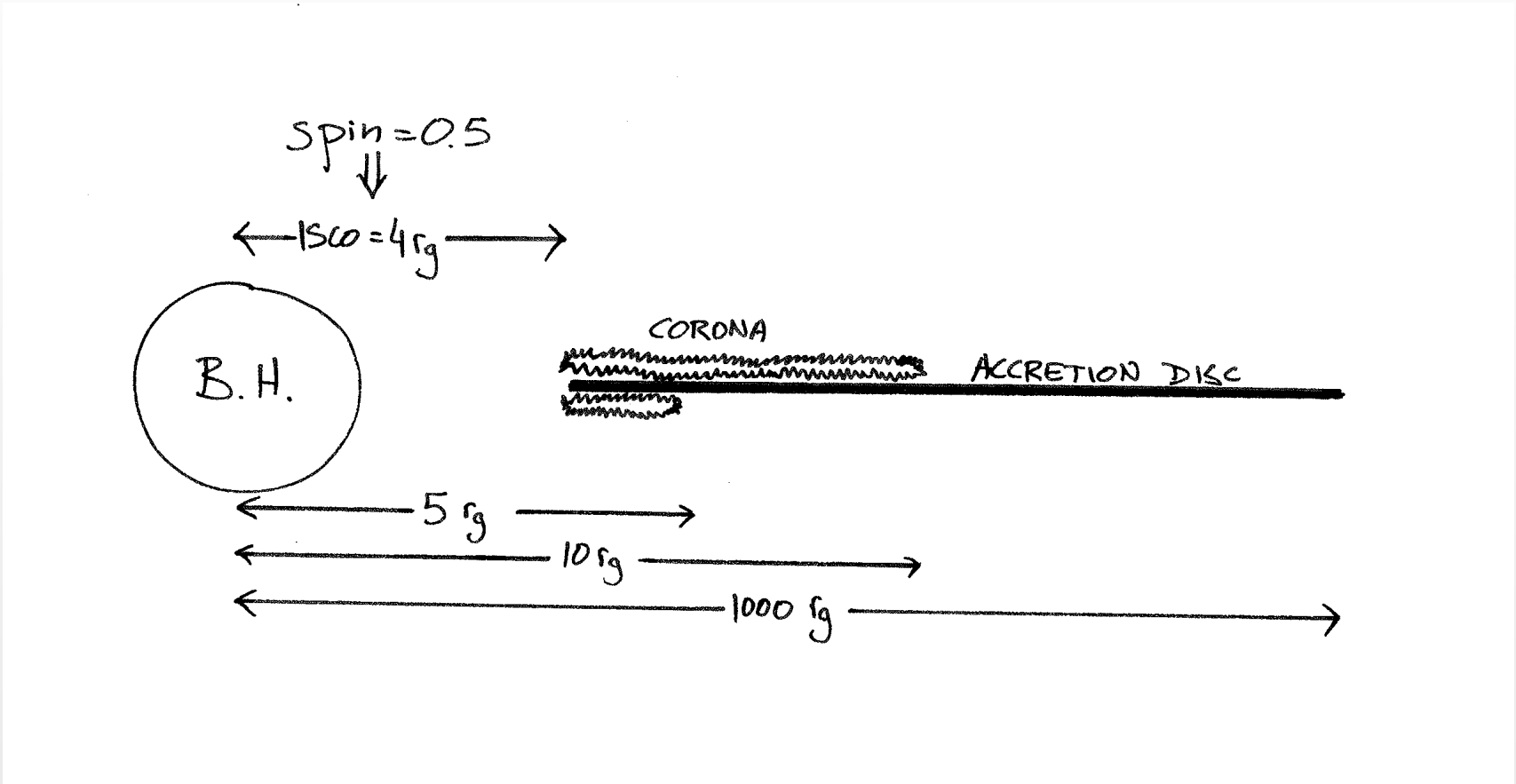
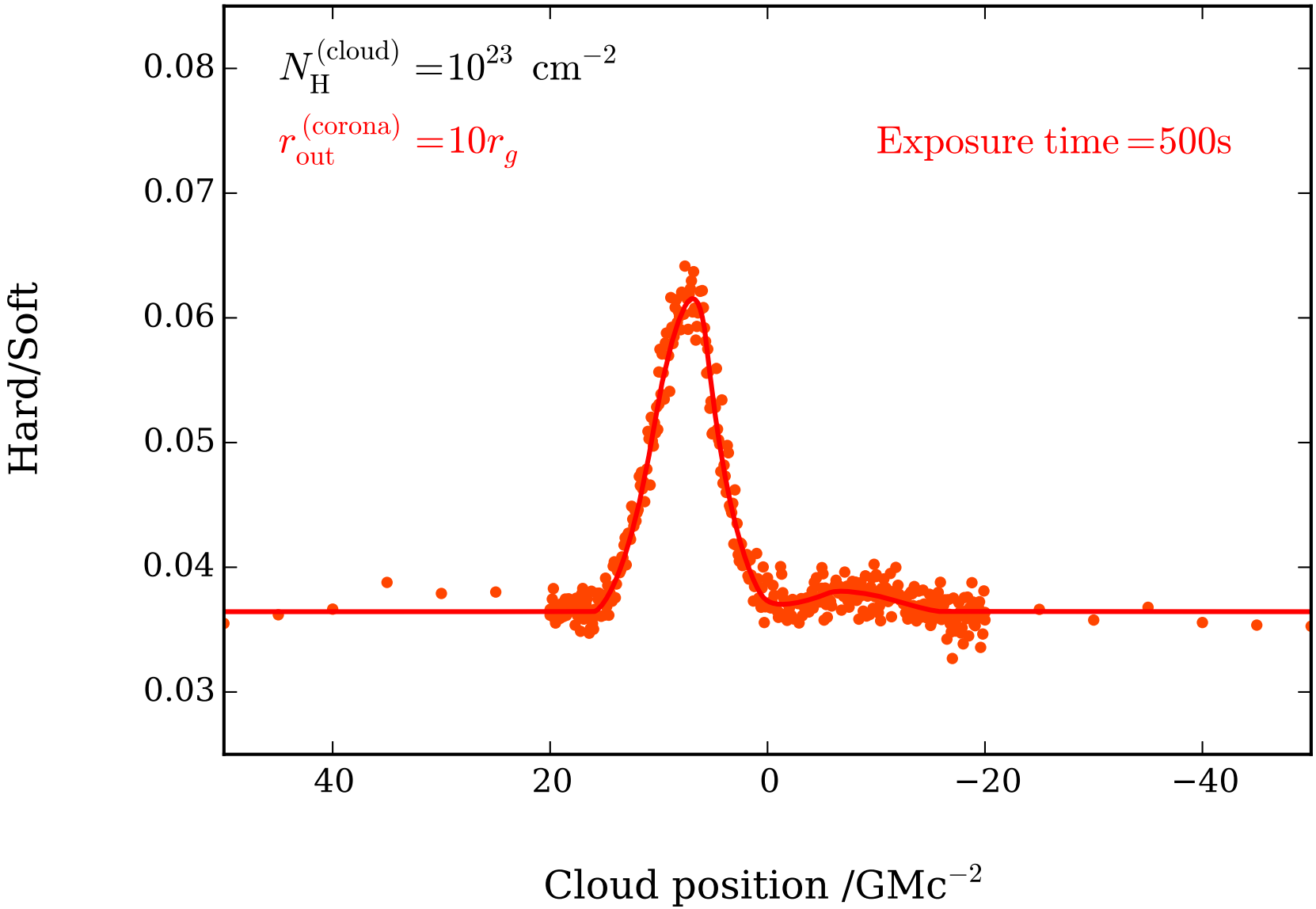


The H/S lightcurves



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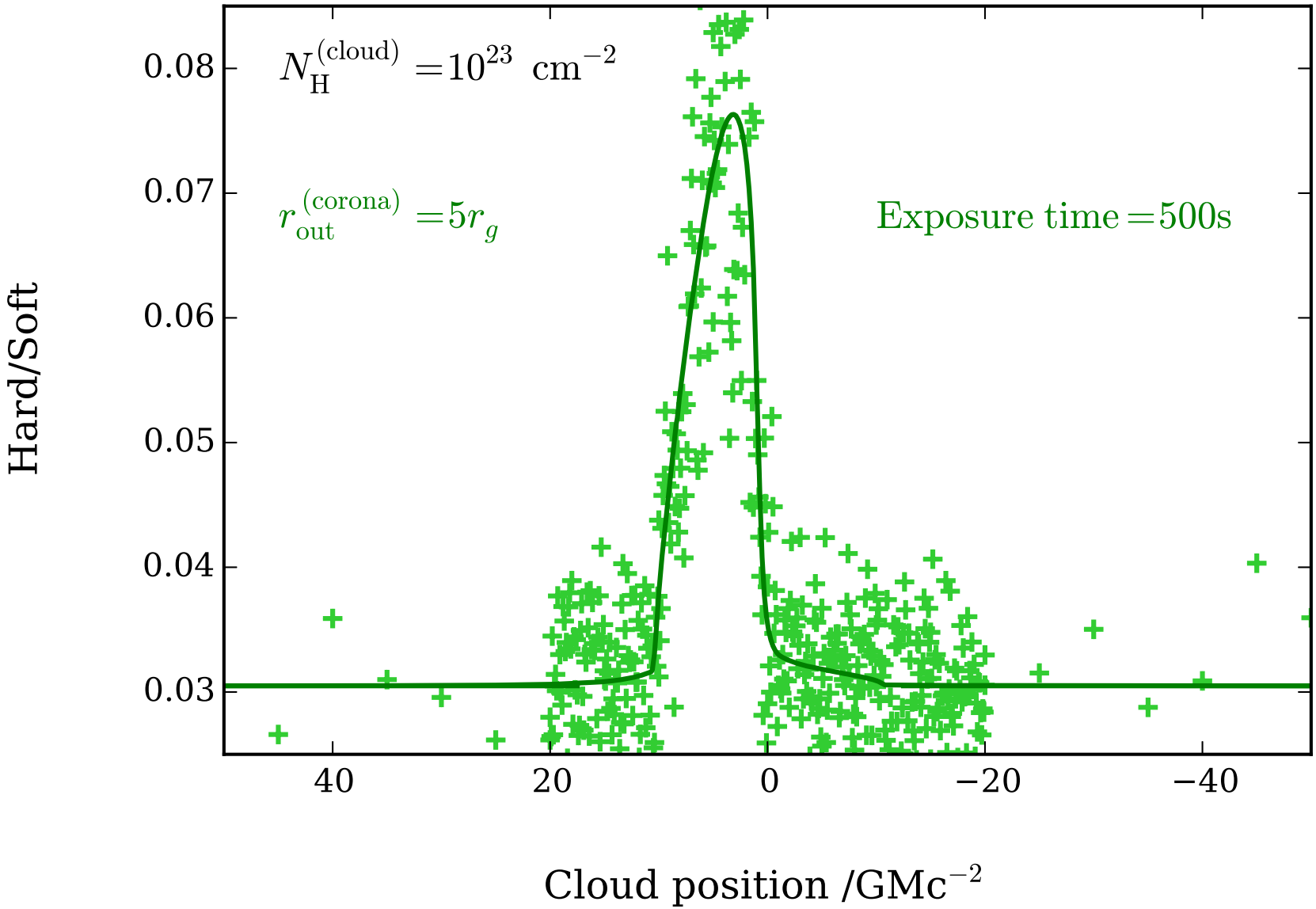
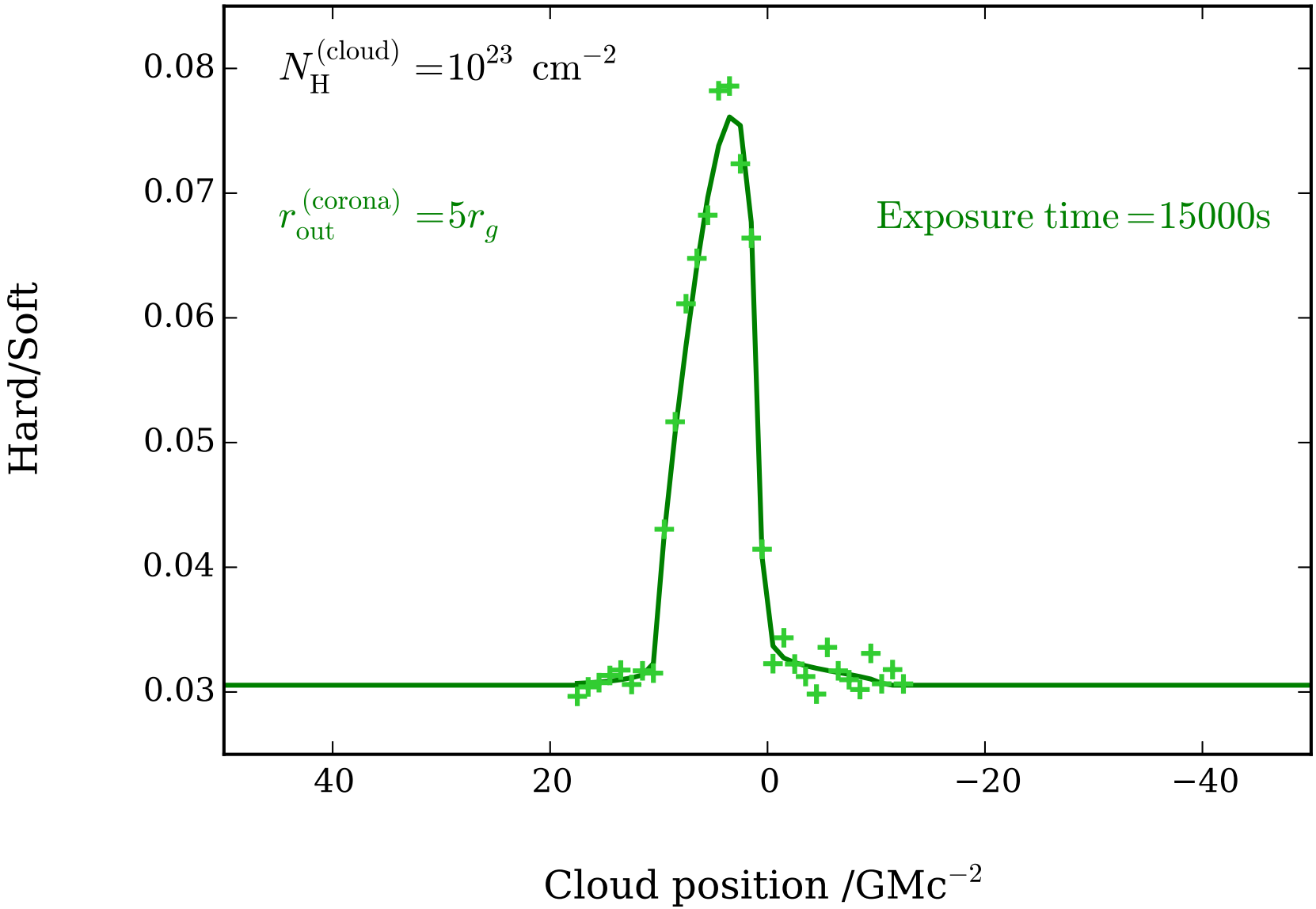


The H/S lightcurves



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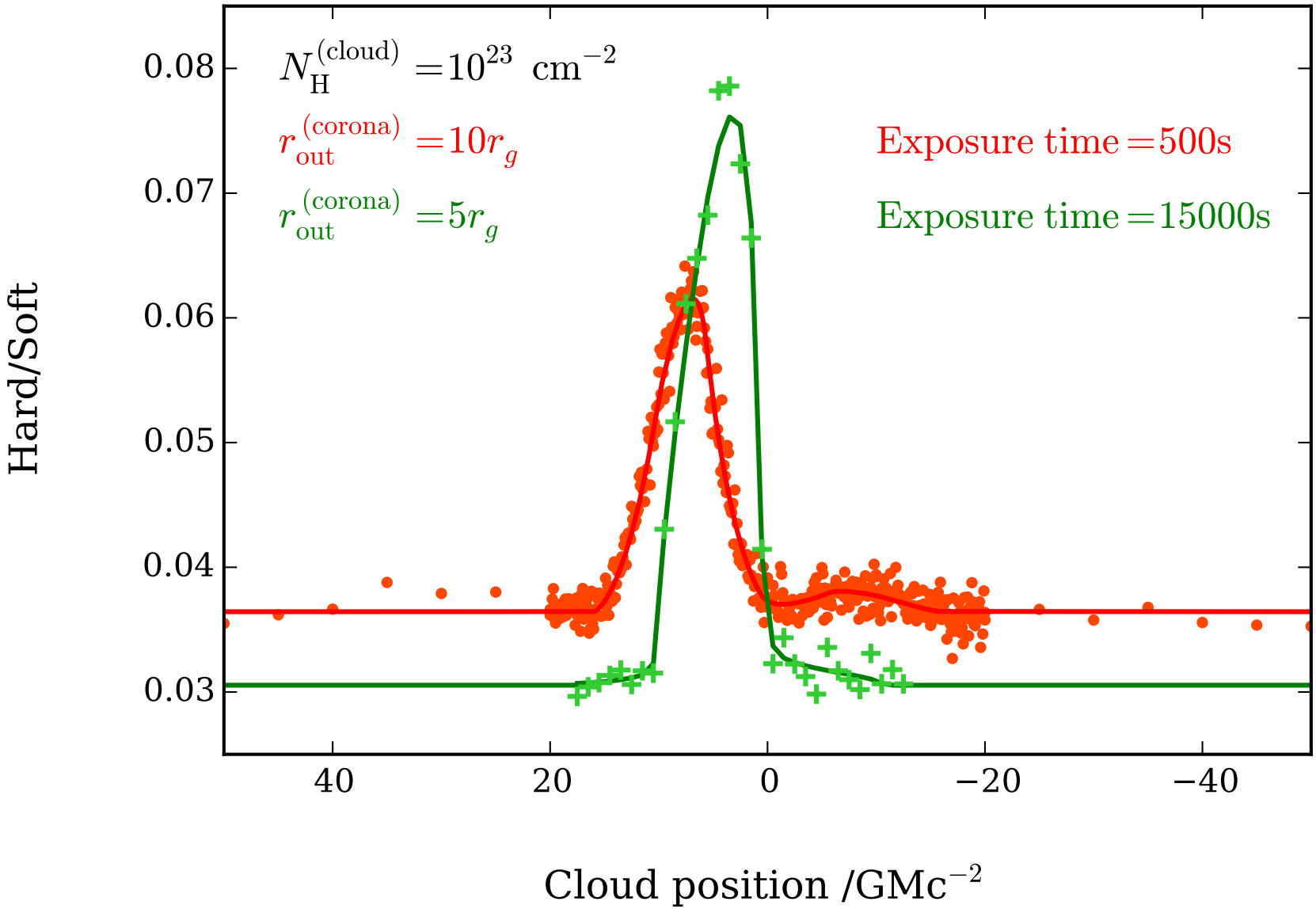
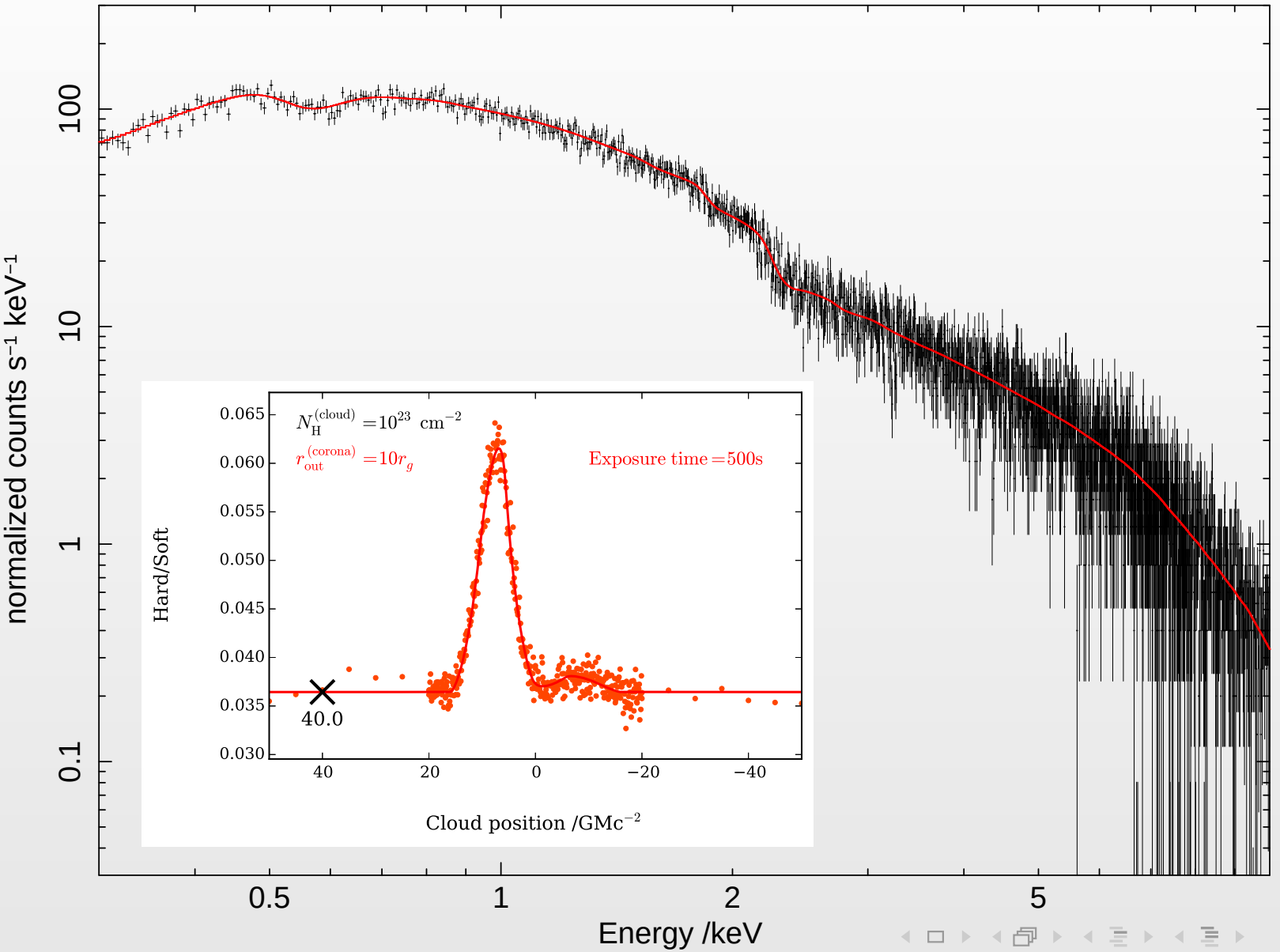


Detectability on spectral features



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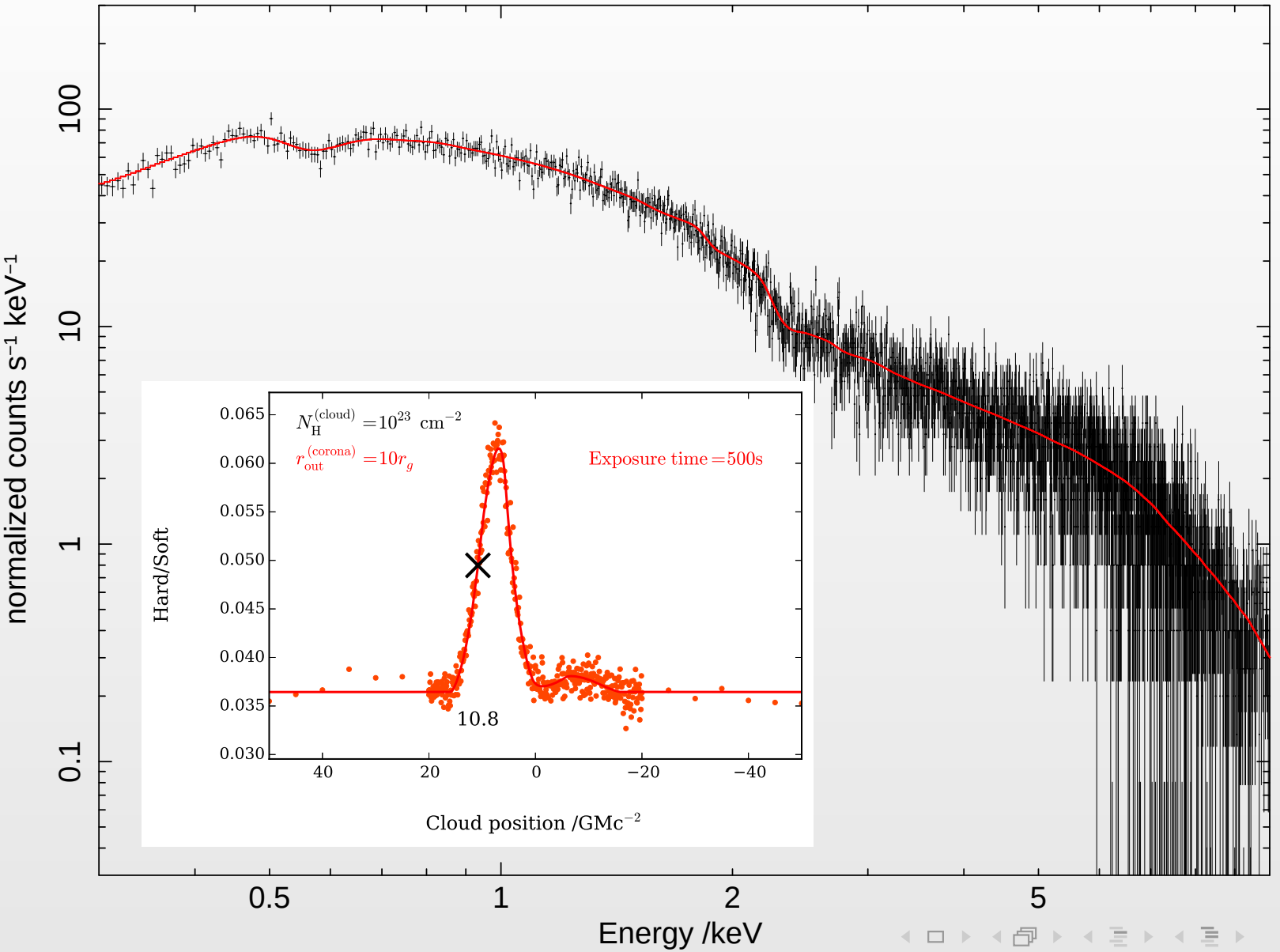

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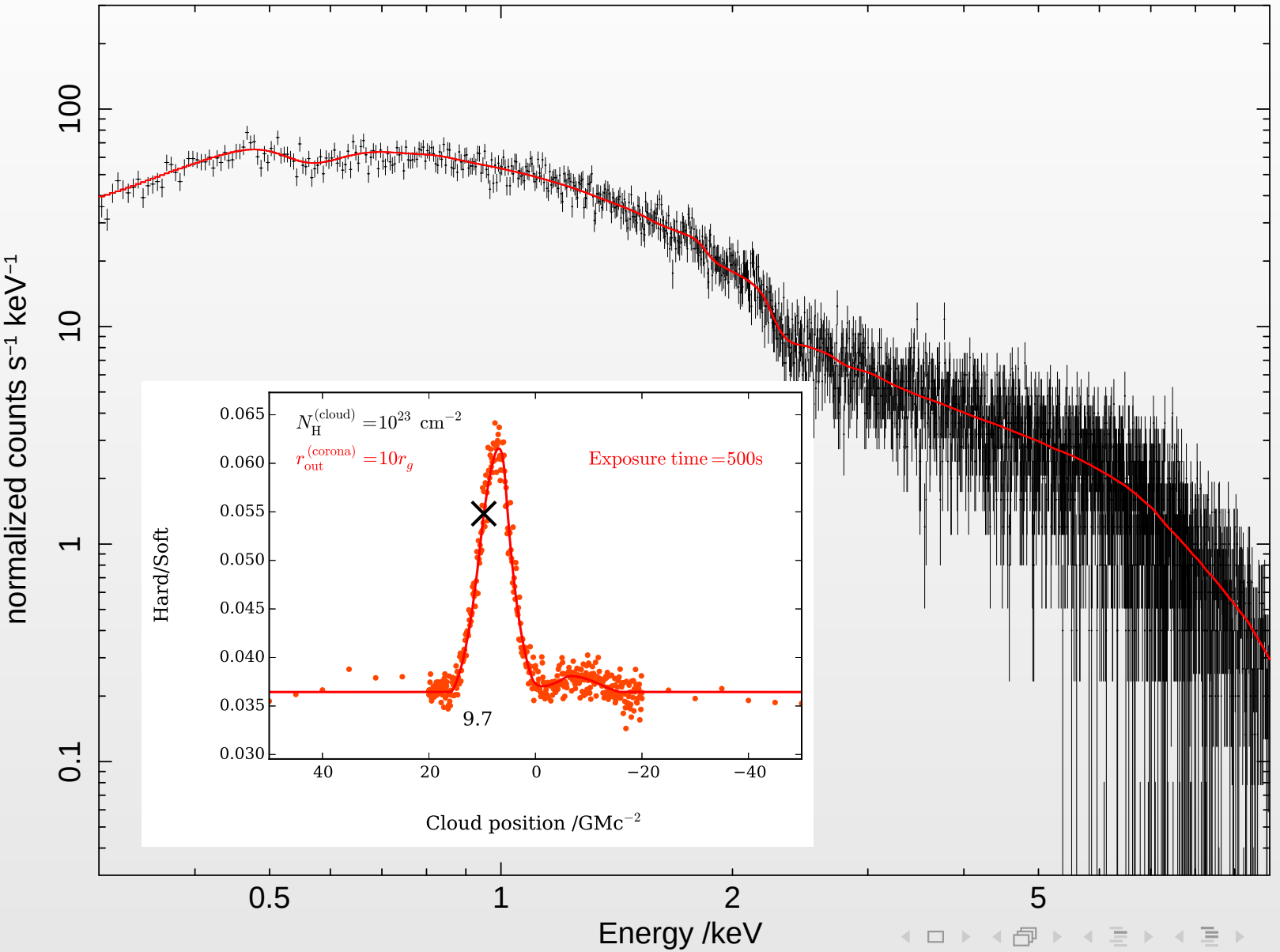

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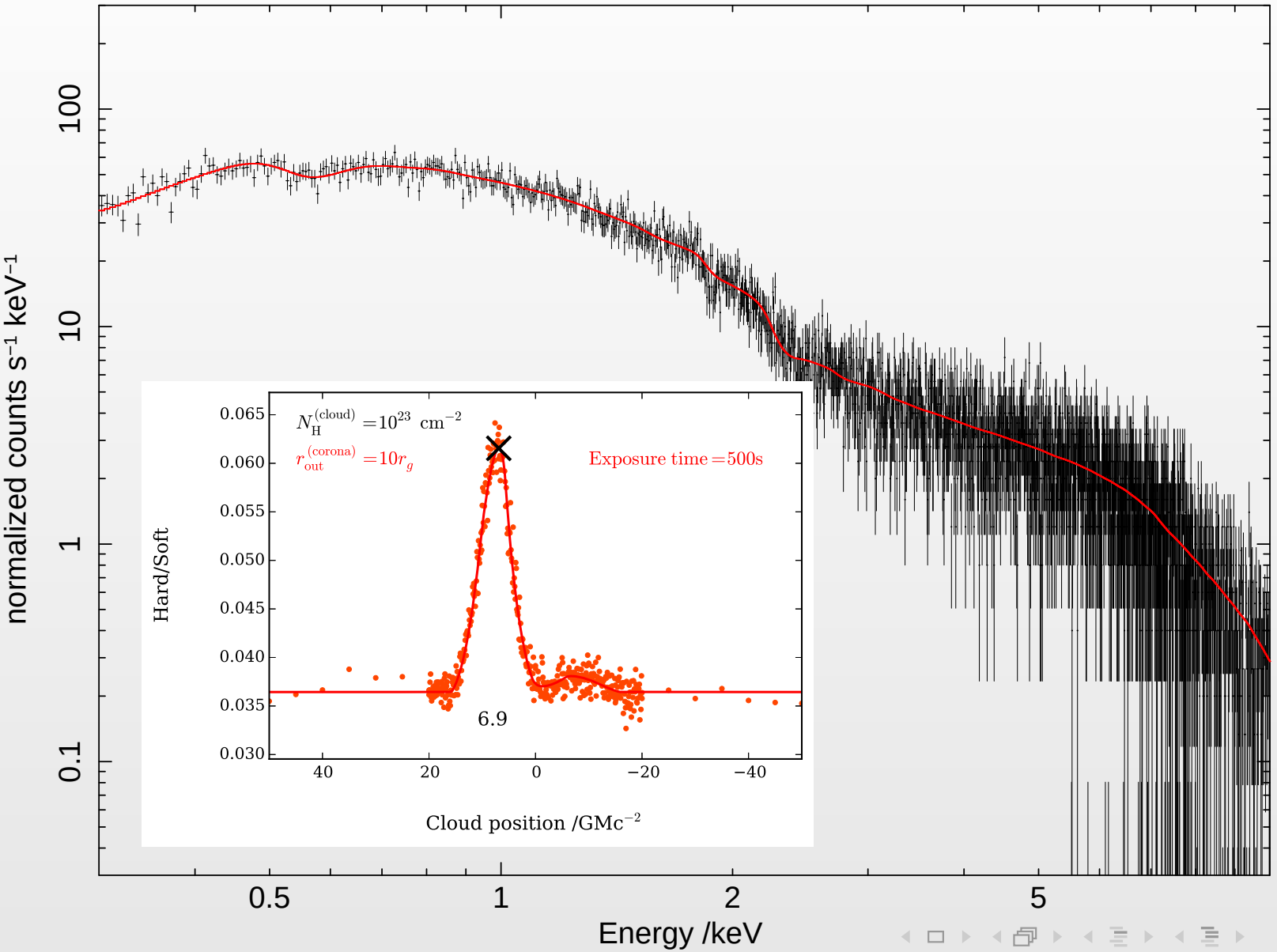

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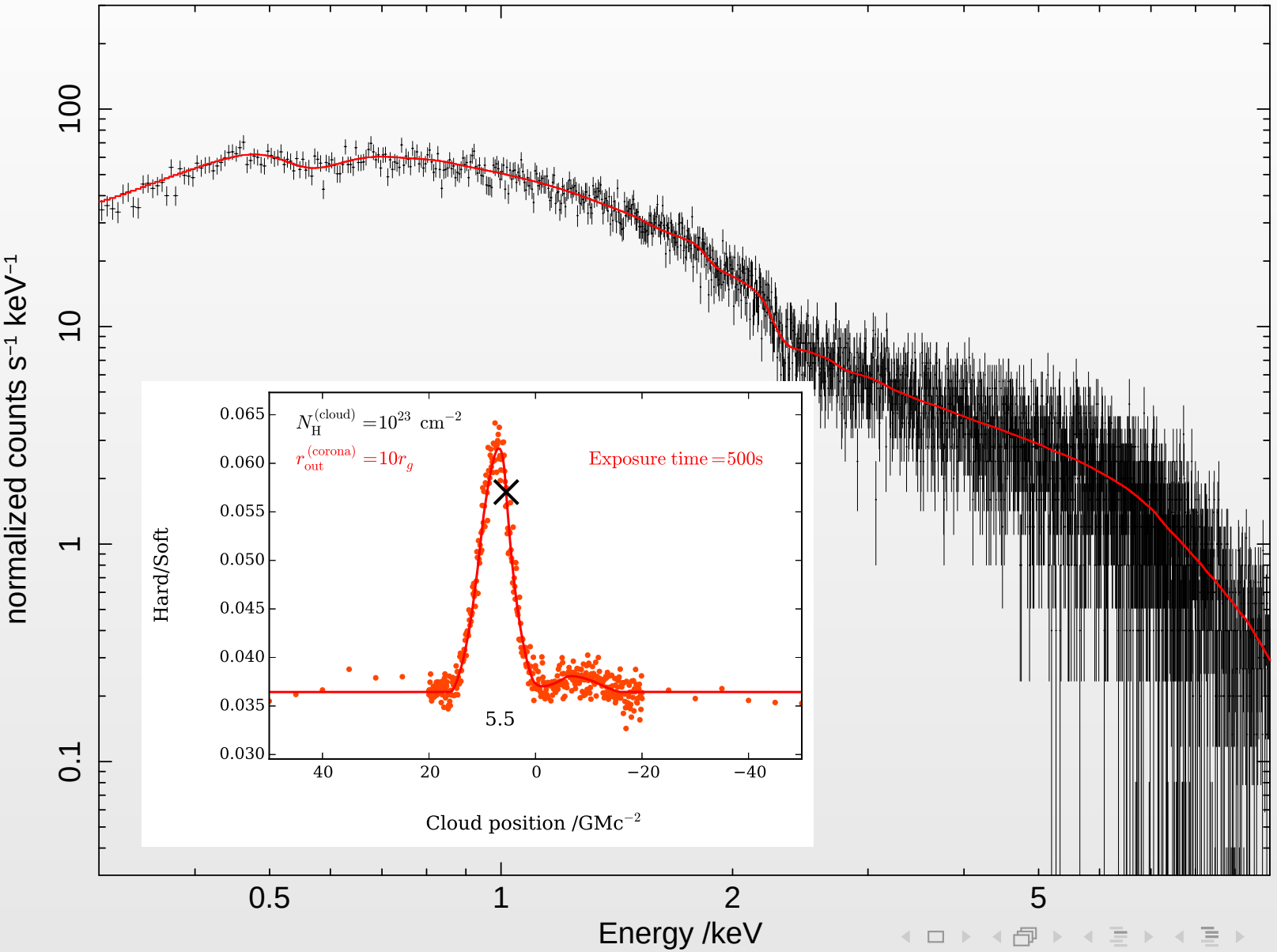

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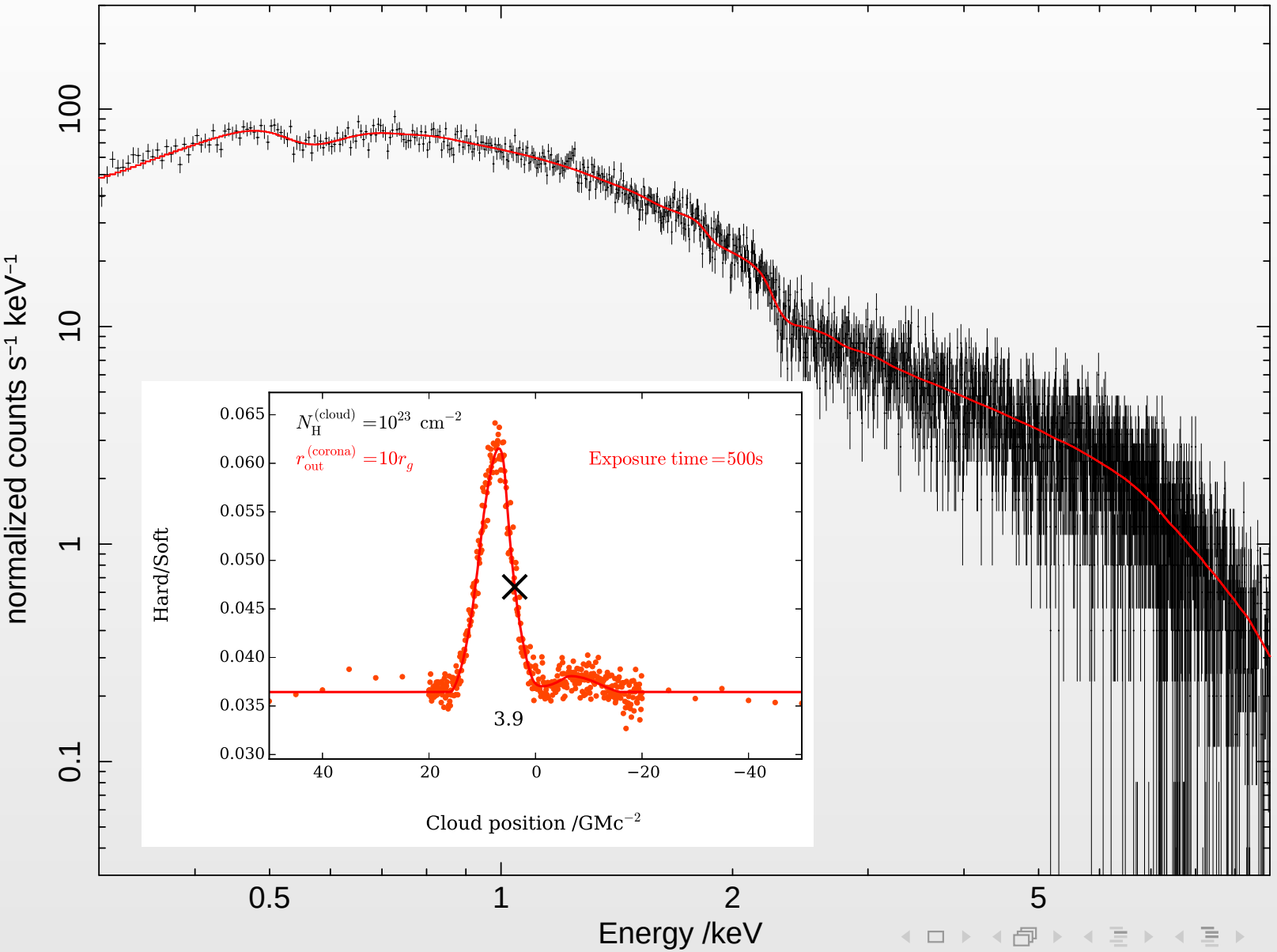

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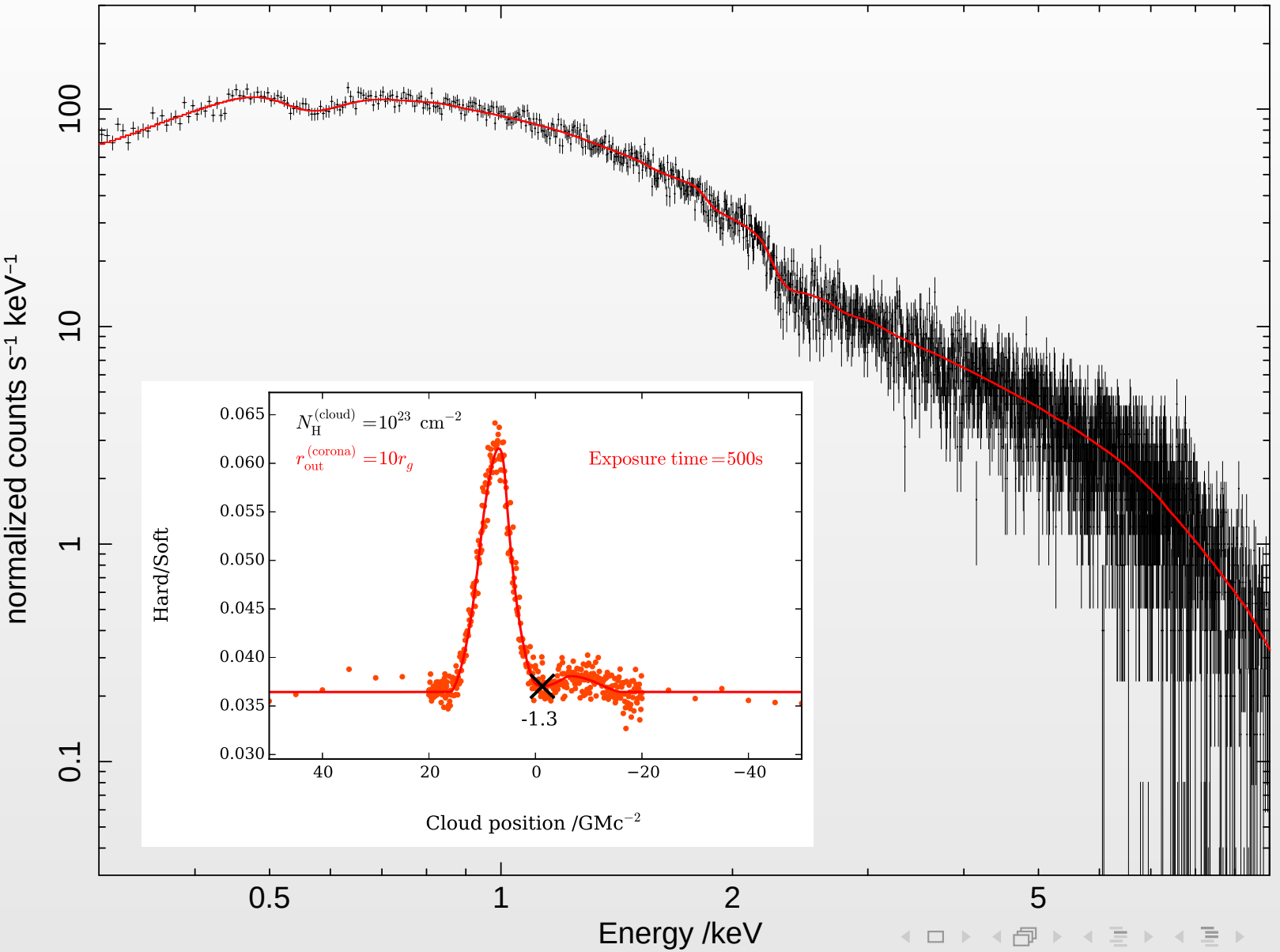

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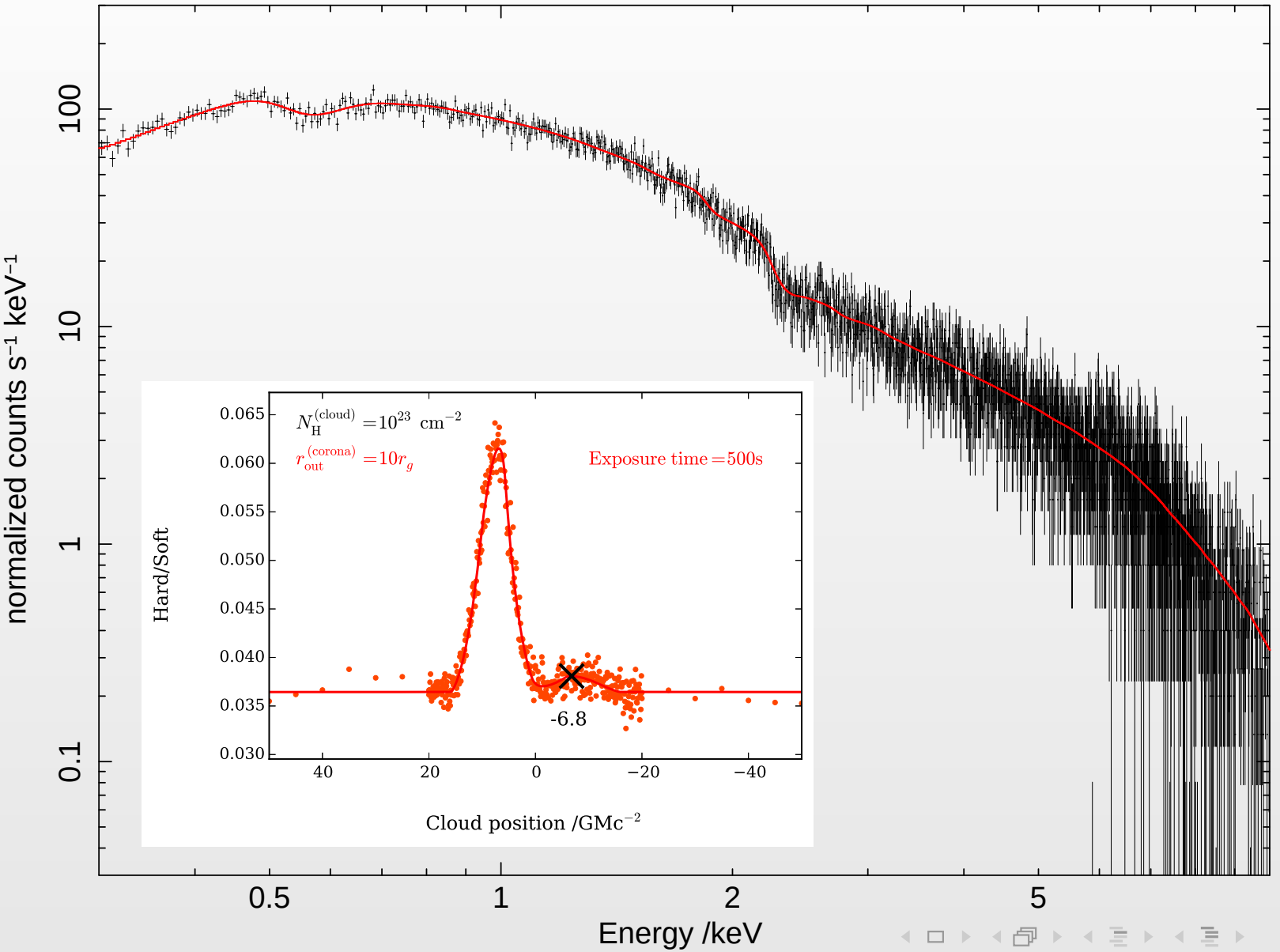

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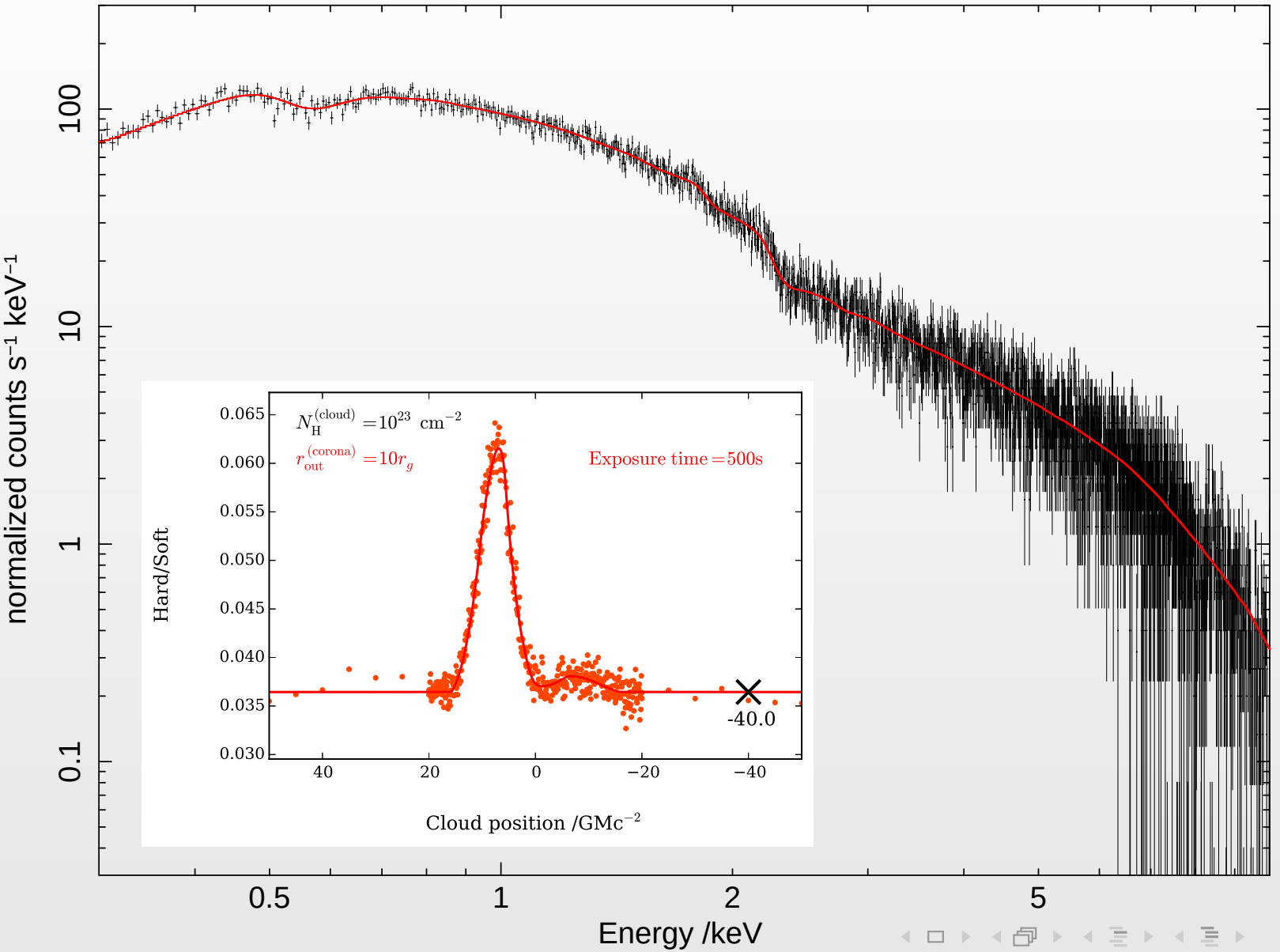

Conclusions

- Preliminar results are promising
- Tentative detections with current instruments (NGC1365, SWIFT J2127.4+5654)
- Ongoing and future work
  - Fit covering fraction profiles
  - Fit simulated (and real!) spectra
  - Consider other instruments' spectra (NuSTAR, ASTRO–H, ATHENA+)
  - Check degeneracies
  - ...

... SO MUCH WORK TO DO!