1. Preparation

- **software: heasoft, eSASS/Docker, SAOImage ds9**
- **dataset: fm00_3000**_020_EventList_c001.fits**

2. Data extraction

(1) make sure your eSASS has been initialized.

- **for eSASS:**

```
$ esassinit
```

- **for Docker:**

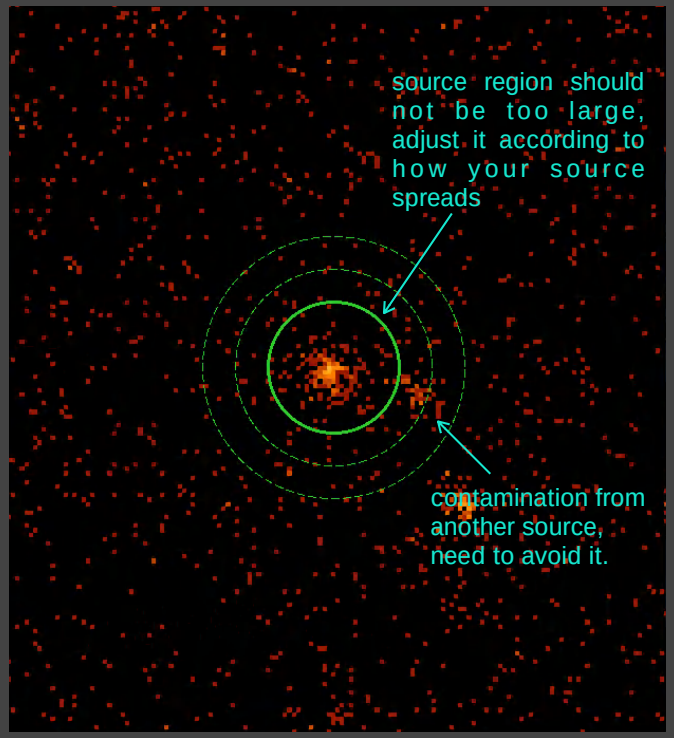
```
$ docker run --volume /path/to/yourdata:/home/idies/workspace/data -ti
--rm erosita/esass:latest /bin/bash
```

(2) keep the process = 1 to run the esass tasks in esass.sh

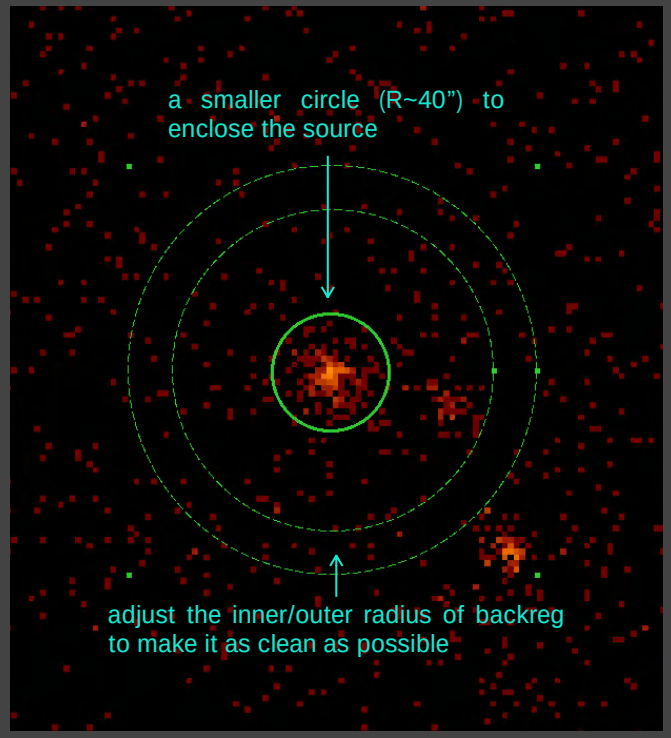
```
$ bash esass.sh
```

- **Note: step by step, and check the outputs of each process**

- **for srctool, the source and background regions should be chosen carefully. Open your counts map in ds9 and determine the most suitable region.**



previous region
src: R=60”
bkg: R_{in}=90” R_{out}=120”



new region
src: R=40”
bkg: R_{in}=110” R_{out}=140”

3. Spectral analysis

- **initialize heasoft**

```
$ heainit
```

- **group the spectrum for better analysis, e.g. require 20 photons per bin**

```
$ grppha your_src_spec.fits your_src_spec_bin20.fits
$ group min 20
$ exit
```

- **enter the xspec environment, load the spectrum and add model to fit it**

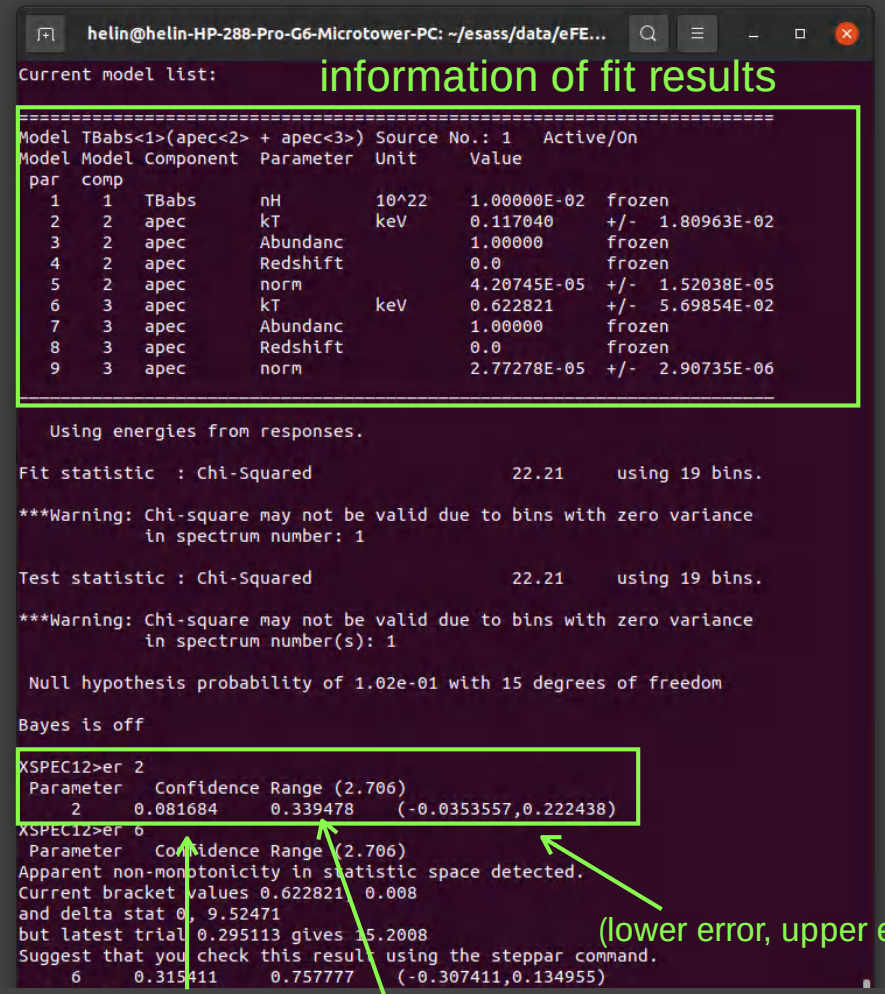
```
$ xspec
$ da your_src_spec_bin20.fits
$ cpd /xw     # open a xspec window
$ setp e     # set the unit of x-axis to energy
$ ig **-0.2 8.-**     # ignore the ineffective energy bins
$ pl ld      # plot the data
$ mo tb*apec      # add a model (absorbed hot plasma)
$ /*
$ fit
$ pl ld del      # plot data and residual
$ show all       # show all the information
$ er 2      # calculate the errors of parameter 2 (i.e. kT)
$ save all my_fit1.xcm      # save all the processes for fast loading
```

- **if you have done these steps before and save it as a .xcm file, you can load it by typing:**

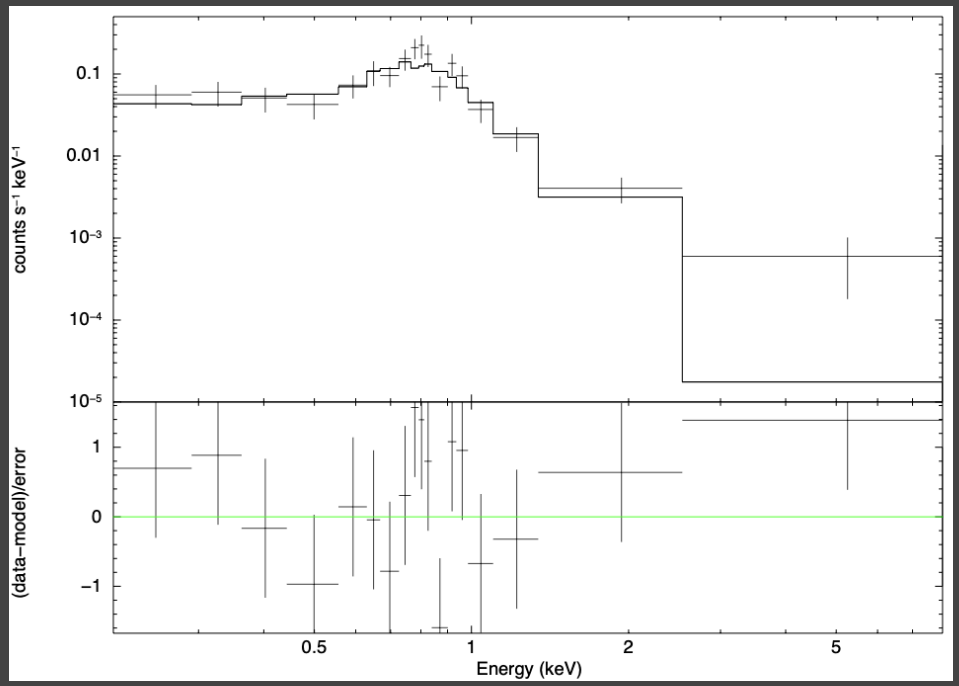
```
$ @ my_fit1.xcm
```

```
#it saves time if you want to do some modification for your previous results
```

- **examples for output:**



model: tb*(apec+apec)



estimate the goodness of fitting!

Chi-squared/d.o.f = 22.21/15

record and report this value!

An example for presentation

An introduction of X-ray analysis for EY Cyg

MG21260002 何琳

- INTRODUCTION
- OBSERVATION
- DATA REDUCTION
- RESULTS

INTRODUCTION

EY Cyg

- Dwarf Novae of U Gem type
- Orbit Period: 4867 s
- currently transfer mass at a low rate
- Primary: 1.10 ± 0.09 $M_{\odot}$

  Secondary: 0.44 ± 0.02 $M_{\odot}$ (K0 or late type)
- inclination angle: 13°~15°
- distance: 636 ± 8 *Mpc*

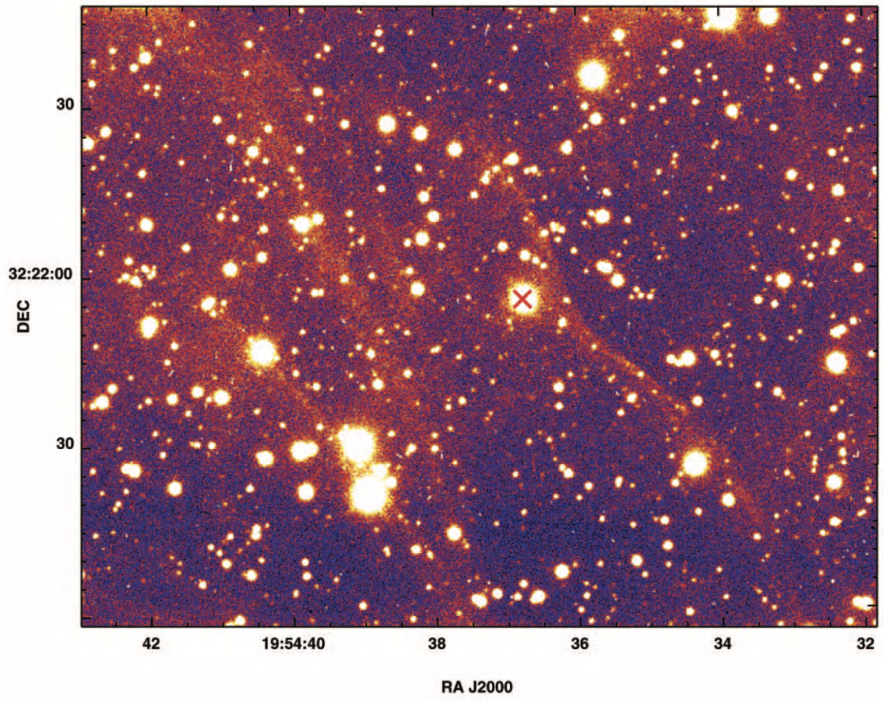


Figure 1. The images of EY Cyg in H_{α} image

Sion et al. 2004

OBSERVATION

Observation of XMM-Newton

ObsID: 0400670101

Exposure time: 45.4 ks

pn net count rate(s-1): $0.3253^{+0.0033}_{-0.0033}$

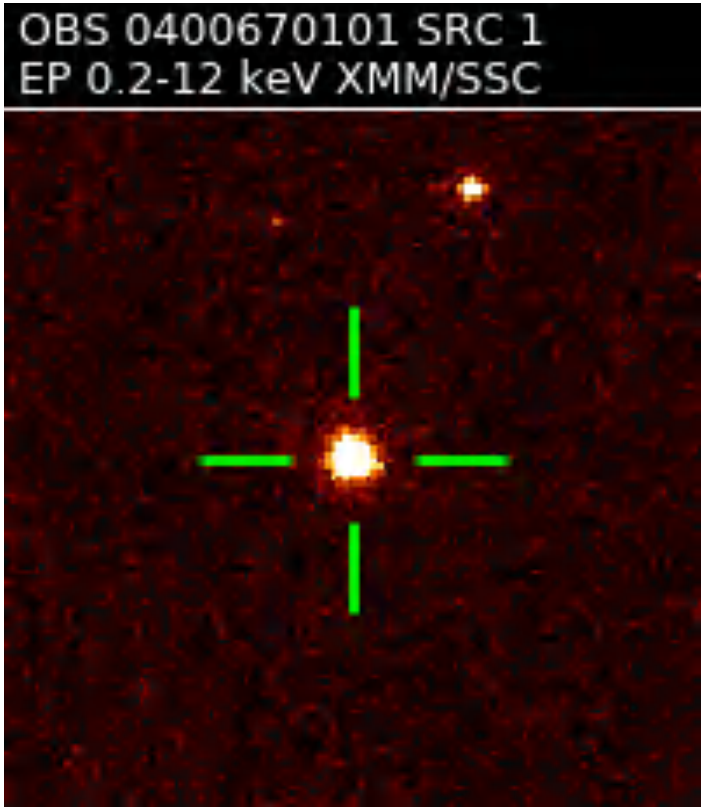


Figure 2. Observation of XMM Newton

DATA REDUCTION

Produce

Run emchain and epchain to produce calibrated photon event file

Extract

Run evselect to extract the source and background spectra

Correct

Run barycen to correct event time to TDB

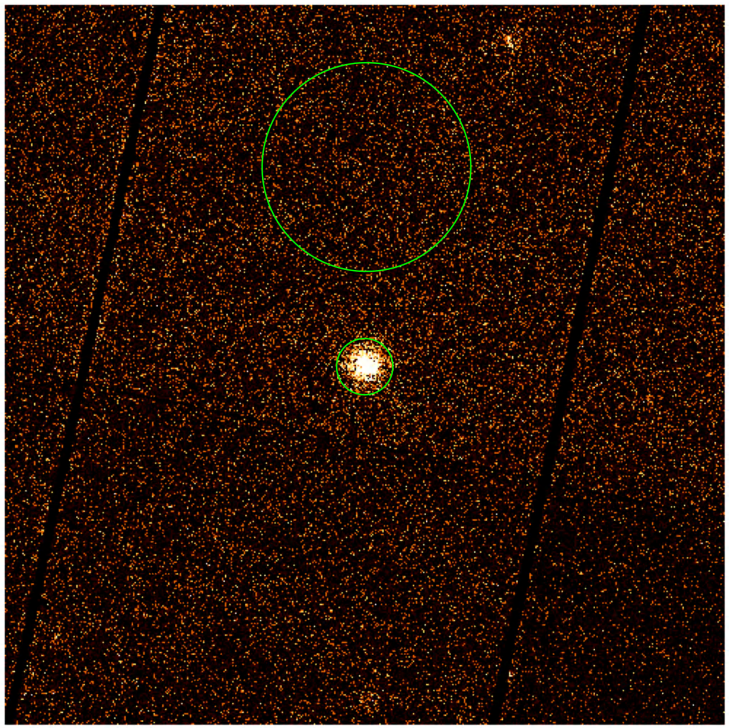


Figure 3. Source region & Background region

RESULTS

MODEL:tbabs*mkcflow			
nH(10^{20})	**highT**	**Abundance**	**Chi-squared**
$3.25^{+0.650}_{-0.561}$	$22.5^{+4.69}_{-3.79}$	$0.699^{+0.263}_{-0.206}$	1.07

an interstellar medium absorption model

A cooling flow model

best fit mass accretion rate

$\sim 1.33 \times 10^{-11}\ M_{\odot}\ yr^{-1}$

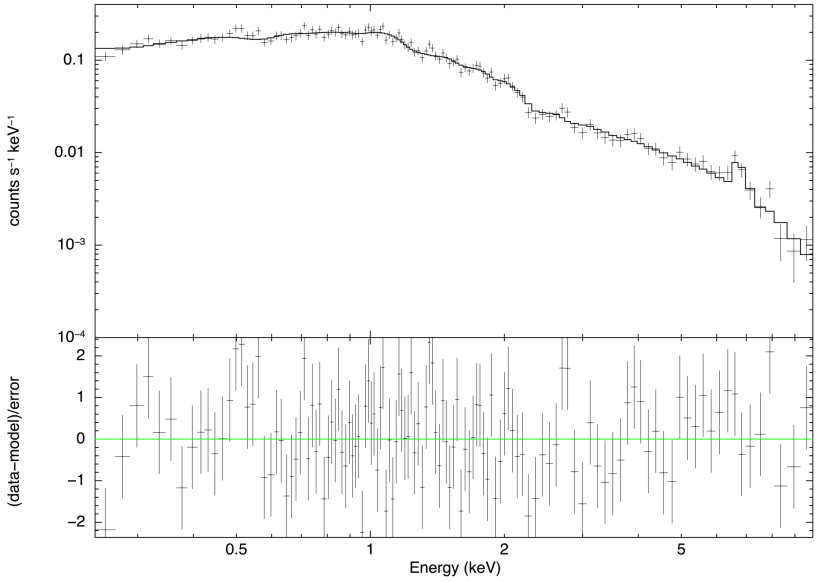


Figure 4. Spectrum

RESULTS

PHENOMENON

Period = 4838.71 s

Another frequency

EXPLANATION

transient or artefact

—— use the whole exposure time!

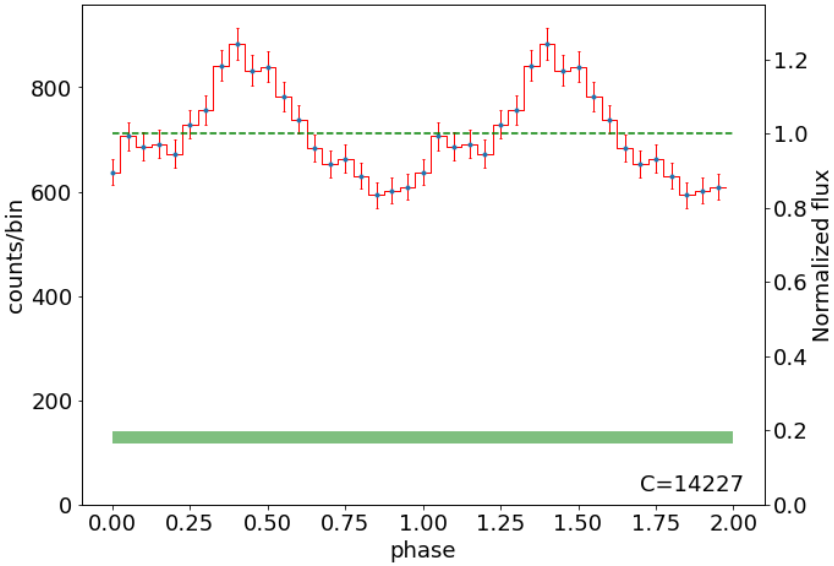


Figure 5. Light curve(bin = 20)

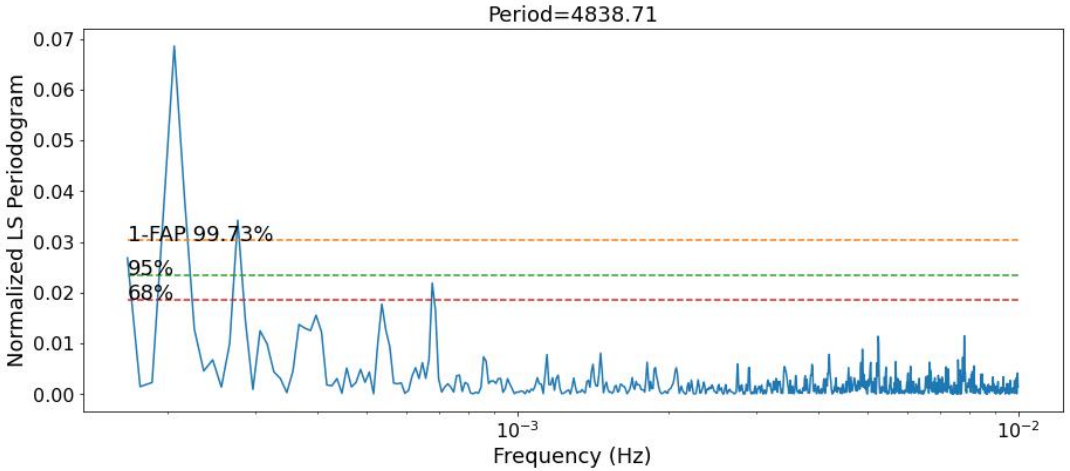


Figure 6. Lomb-Scargle periodogram

REFERENCE

1. Bangzheng Sun et al. *Monthly Notices of the Royal Astronomical Society*, Volume 499, Issue 2, December 2020, Pages 3006–3018

2. Nabizadeh A., Balman S., 2020, *Advances in Space Research*, 66, 1139

3. Echevarría J., Michel R., Costero R., Zharikov S., 2007, *A&A*, 462, 1069

1. Sion E. M., Winter L., Urban J. A., Tovmassian G. H., Zharikov S., Gänsicke B. T., Orio M., 2004, *AJ*, 128, 1795

THANK YOU