ReadMe

Junjie Mao
jmao2018@hiroshima-u.ac.jp

Contents

1 Top-level directory structure

File or folder	Content
./ReadMe.pdf	This document
./data_obs/	X-ray spectra data and response files
./spex/	SPEX fitting results
./img/	Image data and ds9 region files
./pynb/	Python notebooks to reproduce Figure 1 in the paper
./requirements.txt	List of python3 libraries required

Table 1: Top-level directory structure

File	Content
./data_obs/Arp299_01to20_rgs.res	RGS response matrix file
./data_obs/Arp299_01to20_rgs.spo	RGS spectral data file
./data_obs/Arp299_01to20_pn.res	EPIC/pn response matrix file
./data_obs/Arp299_01to20_pn.spo	EPIC/pn spectral data file

Table 2: The XMM-Newton spectral data and responses files in SPEX format.

2 X-ray spectral data and response files

3 SPEX fitting results

SPEX files to reproduce fitting results listed in Table 2 of the paper. X-ray spectral data and response files in ./data_obs are used.

The main SPEX command file is ./spex/main_cxtp.com, where those command lines starting with "log exe ./log/pars_cxtp_" will load the parameters required to reproduce the fitting results. The default is to reproduce Model M4 in Table 2. To reproduce results of a specific model, please comment out all other lines starting with "log exe ./log/pars_cxtp_*.com".

Note that some models will couple parameters (e.g., the Fe and Ni abundances in Model M6, and turbulence velocity in Models M2). Once these models are reproduced, before reproduce other models, it is essential to decouple these parameters.
Important note: It might take a few minutes to reproduce the results.

4 FITS images and ds9 region files used for Figure 1 in the paper

A general thread to create a true color image with ds9 can be found here.

5 Python 3 jupyter notebooks to reproduce Figures in the paper

5.1 Figure 2

./pynb/run_plot_dnma_01to20.py

- Subroutine:
  - ./pynb/gps.py
  - ./pynb/gps_gridspec.py

File	Content
./spex/init.com	SPEX command file for initialization
./spex/mdl_tp.com	SPEX command file to set-up the model components
./spex/main_cxtp.com	SPEX command file to reproduce the fitting results listed in Table 2
./spex/log/pars_cxtp_s.com	SPEX parameter files of Model S in Table 2
./spex/log/pars_cxtp_t.com	SPEX parameter files of Model T in Table 2
./spex/log/pars_cxtp_m1.com	SPEX parameter files of Model M1 in Table 2
./spex/log/pars_cxtp_m2.com	SPEX parameter files of Model M2 in Table 2
./spex/log/pars_cxtp_m3.com	SPEX parameter files of Model M3 in Table 2
./spex/log/pars_cxtp_m4.com	SPEX parameter files of Model M4 in Table 2
./spex/log/pars_cxtp_m5.com	SPEX parameter files of Model M5 in Table 2
./spex/log/pars_cxtp_m6.com	SPEX parameter files of Model M6 in Table 2

Table 3: SPEX fitting results

  - ./pynb/spex_qdp.py

- Input:
  - ./pynb/dat/plot_dnma_m4.qdp
- Output:
  - ./pynb/fig/plot_dnma_01to20.pdf

5.2 Figure 3

./pynb/run_plot_cf_arp_all.py

- Subroutine:
  - ./pynb/calc_ceap.py
  - ./pynb/gps.py
  - ./pynb/gps_gridspec.py
  - ./pynb/pou_2psu.py
- Input:
  - ./pynb/dat/Arp299.dat

File	Content
./img/Arp299_XMM_EPIC_soft.fits	XMM-Newton EPIC soft X-ray ($0.3-2$ keV) image
./img/Arp299_HST_ACS_WFC_f814w.fits	HST ACS/WFC image with the F814W filter
./img/Arp299_Spitzer_IRAC_I1.fits	Spitzer IRAC Channel I image
./img/reg/ds9_epic_0861250101.reg	XMM-Newton EPIC source region file
./img/reg/ds9_rgs_0112810101.reg	XMM-Newton ObsID 0112810101 RGS source region file
./img/reg/ds9_rgs_0679381101.reg	XMM-Newton ObsID 0679381101 RGS source region file
./img/reg/ds9_rgs_0861250101.reg	XMM-Newton ObsID 0861250101 RGS source region file
./img/reg/ds9_rgs_0861250201.reg	XMM-Newton ObsID 0861250201 RGS source region file
./img/reg/ds9_rgs_0861250301.reg	XMM-Newton ObsID 0861250301 RGS source region file
./img/reg/ds9_src.reg	Target source region file
./img/reg/ds9_scale_1arcmin.reg	Scale length (1 arcmin) region file

Table 4: The XMM-Newton spectral data and responses files in SPEX format.

  - ./pynb/database/

- Output:
  - ./pynb/fig/cf_arp_obs_all.pdf

Important note: It is are free to use calc_ceap.py and the associated ./database/ but please cite the ApJL paper and this zenodo package.

6 User guide for Docker, SPEX, Anaconda3

It might be possible that users fail to reproduce the exact results due to conflict environment settings or software packages updates. In this case, to reproduce the results using python, it is recommended to build a Docker container, starting with the Anaconda3 (continuumio/anaconda3:5.3.0) basic image. To reproduce results using SPEX, one can further install the SPEX v3.06.00 docker image. Please refer to this thread on how to run SPEX through Docker.