X-ray Spectral Fitting

Prague | February 2022

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Astronomical Institute of the Czech Academy of Sciences

All times are in Central European Time and hands-on sessions are in-person only.

Monday 7th February 2022

– Day 1, X-ray spectral fitting introduction –
(Talk chair: Jiří Svoboda)

9:00 – 9:30	– ***Coffee break***
9:30 – 9:45	– ***Welcome*** – Presenter: **Peter Boorman**
9:45 – 11:00	– Hands-on: ***Introduction to Xspec/PyXspec***
11:00 – 12:00	– Hands-on: ***Introduction to Sherpa***
12:00 – 14:00	– ***Lunch***
14:00 – 15:00	– Plenary lecture: ***The Past, Present & Future of X-ray Spectral Analysis*** – Presenter: **Keith Arnaud**
15:00 – 15:30	– ***Coffee break***
15:30 – 16:00	– ***Winter school photo***
16:00 – 17:00	– Plenary lecture: ***High Energy Astrophysics Spectroscopy*** – Presenter: **Richard Mushotzky**

– End of day 1 –

X-ray Spectral Fitting

Prague | February 2022

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Tuesday 8th February 2022

– ***Day 2, BXA introduction*** –
(*Talk chair: Daniel Kynoch*)

9:00 – 9:30	– ***Coffee break***
9:30 – 11:00	– Hands on: ***Xspec & Sherpa exercises***
11:00 – 12:00	– Plenary lecture: ***Introductory talk for Bayesian X-ray Analysis*** – Presenter: **Johannes Buchner**
12:00 – 14:00	– ***Lunch***
14:00 – 14:30	– Invited talk: ***X-ray spectral analysis in eROSITA Final Equatorial Depth Survey (eFEDS): an example of using BXA*** – Presenter: **Teng Liu**
14:30 – 15:00	– Invited talk: ***XMMFITCAT-Z: Using photo-z information within BXA*** – Presenter: **Angel Ruiz**
15:00 – 15:30	– ***Coffee break***
15:30 – 16:30	– Hands-on: ***BXA exercises, session 1: spectral fitting & model comparison***
15:30 – 16:30	– ***Questions & discussion***

– ***End of day 2*** –

Wednesday 9th February 2022

– Day 3, BXA introduction –
(*Talk chair: Peter Boorman*)

9:00 – 9:30	– ***Coffee break***
9:30 – 12:00	– Hands-on: ***BXA exercises, session 1: spectral fitting & model comparison***
12:00 – 14:00	– ***Lunch***
14:00 – 14:30	– Invited talk: ***A BXA-driven study of reliability of X-ray Spectral fits in determining AGN torus morphology*** – Presenter: **Tathagata Saha**
14:30 – 15:00	– Invited talk: ***Deriving redshifts from X-ray spectra of obscured AGN using BXA*** – Presenter: **Charlotte Simmonds**
15:00 – 15:30	– ***Coffee break***
15:30 – 16:30	– Hands-on: ***BXA exercises, session 1: spectral fitting & model comparison***
16:30 – 17:00	– ***Questions & discussion***
19:00	– ***Virtual social evening*** – An opportunity for all participants to meet, greet and play online games. – Organiser: **Abhijeet Borkar**

– End of day 3 –

X-ray Spectral Fitting

Prague | February 2022

Astronomical Institute of the Czech Academy of Sciences

Thursday 10th February 2022

– Day 4, BXA more advanced concepts –

(Talk chair: Anastasia Yilmaz)

9:00 – 9:30	– ***Coffee break***
9:30 – 10:30	– Hands-on: ***More computationally-expensive analyses with BXA*** – Presenter: **Peter Boorman**
10:30 – 12:00	– Hands-on: ***BXA exercises, session 2: more advanced concepts***
12:00 – 14:00	– ***Lunch***
14:00 – 14:30	– Invited talk: ***Complex modelling with many datasets within BXA*** – Presenter: **Devang Liya**
14:30 – 15:00	– Invited talk: ***Exploring the obscuration properties of AGN in the Chandra Deep Wide Field Survey with BXA*** – Presenter: **Alberto Masini**
15:00 – 15:30	– ***Coffee break***
15:30 – 16:30	– Hands-on: ***BXA exercises, session 2: more advanced concepts***
16:30 – 17:00	– ***Questions & discussion***
19:00	– ***Winter school meal*** – Venue: TBD

– End of day 4 –

X-ray Spectral Fitting

Prague | February 2022

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Friday 11th February 2022

– Day 5, BXA more advanced concepts –

(*Talk chair: Jiří Svoboda*)

9:00 – 9:30	– ***Coffee break***
9:30 – 12:00	– Hands-on: ***BXA exercises, session 2: more advanced concepts***
12:00 – 14:00	– ***Lunch***
14:00 – 14:30	– Invited talk: ***Bayesian spectral analysis for large XMM surveys*** – Presenter: **Lingsong Ge**
14:30 – 15:00	– Invited talk: ***The synergy between Monte Carlo Radiative Transfer and Artificial Neural Networks*** – Presenter: **Gabriele Matzeu**
15:00 – 15:30	– ***Coffee break***
15:30 – 16:30	– Hands-on: ***BXA exercises, session 2: more advanced concepts***
16:30 – 17:00	– ***Closing remarks***

– End of winter school –

X-ray Spectral Fitting

Prague | February 2022

7th February
14:00–15:00

– ***The past, present & future of X-ray spectral analysis (plenary)***
– Presenter: **Keith Arnaud**
University of Maryland, USA
– Personal website
– ***Abstract:***
TBD.

7th February
16:00–17:00

- ***High Energy Astrophysics Spectroscopy (plenary)***
- Presenter: **Richard Mushotzky**
  University of Maryland, USA
- Personal website
- ***Abstract:***
  High energy astrophysical spectroscopic observations have a unique role to play in astrophysics being able to derive (potentially) the basic physical parameters (e.g. temperature, density, magnetic field, gravity, chemical composition, ionization state, velocity information, emission process, equilbrium state etc) of a huge class of objects where gravity is very strong or are moving very fast or are 'very hot' or energetic such as the coronae of stars, neutron stars) stellar mass black holes, novae, young supernovae, supernova remnants, Active Galactic Nuclei (AGN), clusters of galaxies, star forming and elliptical galaxies (for a limited set). Detailed understanding of the spectra is key to a huge range of exciting and important issues ranging from the very small (the event horizons of black holes) to the very large (the structure and evolution of clusters of galaxies). However x-ray spectra cover a huge range of wavelengths, atomic species and ionization states as well as a large range of continuum physical processes. Thus interpreting the spectra to derive physical parameters is fundamentally challenging. I will present a (biased) overview of the field and present day challenges.

8th February
11:00–12:00

- ***Bayesian X-ray Analysis (plenary)***
- Presenter: **Johannes Buchner**
  Max Planck Institute for Extraterrestrial Physics, Germany
- Personal website
- ***Abstract:***
  TBD.

8th February
14:00–14:30

- ***X-ray spectral analysis in eROSITA Final Equatorial Depth Survey (eFEDS): an example of using BXA***
- Presenter: **Teng Liu**
  Max Planck Institute for Extraterrestrial Physics, Germany
- Personal website
- ***Abstract:***
  TBD.

8th February
14:30–15:00

- ***XMMFITCAT-Z: Using photo-z information within BXA***
- Presenter: **Angel Ruiz**
  National Observatory of Athens, Greece
- Personal website
- ***Abstract:***
  TBD.

– ***A BXA-driven study of reliability of X-ray Spectral fits in determining AGN torus morphology***

9th February
14:00–14:30

– Presenter: **Tathagata Saha**
Nicolaus Copernicus Astronomical Center, Poland

– ***Abstract:***
TBD.

– ***Deriving redshifts from X-ray spectra of obscured AGN using BXA***
– Presenter: **Charlotte Simmonds**
University of Geneva, Switzerland
– Personal website
– ***Abstract:***

9th February
14:30–15:00

Redshifts are fundamental for our understanding of extragalactic X-ray sources. Ambiguous counterpart associations, expensive optical spectroscopy and/or multimission multiwavelength coverage to resolve degeneracies make estimation often difficult in practice. In this talk I will present a work in which we attempt to constrain redshifts of obscured Active Galactic Nuclei (AGN) using only low-resolution X-ray spectra by fitting AGN X-ray spectra with a moderately complex spectral model incorporating a corona, torus obscurer and warm mirror. Using the Bayesian X-ray Astronomy (BXA) package, we constrain redshift, column density, photon index and luminosity simultaneously. Comparing with spectroscopic redshifts, we find an outlier fraction of 8%, indicating that our model assumptions are valid. The independent XZ estimate is easy to apply and effective for a large fraction of obscured AGN in todays deep surveys without the need for any additional data. Comparing to different redshift estimation methods, XZ can resolve degeneracies in photometric redshifts, help to detect potential association problems and confirm uncertain single-line spectroscopic redshifts.

7th February
14:00–14:30

- ***Complex modelling with many datasets within BXA***
- Presenter: **Devang Liya**
  Indian Institute of Science Education and Research Mohali, India
- Personal website
- ***Abstract:***
  TBD.

7th February
14:30–15:00

- ***Exploring the obscuration properties of AGN in the Chandra Deep Wide Field Survey with BXA***
- Presenter: **Alberto Masini**
  Scuola Internazionale Superiore di Studi Avanzati, Italy
- Personal website
- ***Abstract:***
  TBD.

11th February
14:00–14:30

- ***Bayesian spectral analysis for large XMM surveys***
- Presenter: **Lingsong Ge**
  University of Geneva, Switzerland
- ***Abstract:***
  TBD.

11th February
14:30–15:00

- ***The synergy between Monte Carlo Radiative Transfer and Artificial Neural Networks***
- Presenter: **Gabriele Matzeu**
  University of Bologna, Italy
- Personal website
- ***Abstract:***
  TBD.