

X-ray laboratory module: Lessons + Tutorials

- AGN-galaxy co-evolution, and the role of X-ray surveys
- Physics of radio-quiet AGN
- Physics of radio-loud AGN
- Technological development: Athena and CTA as case studies

Science &
pills of future
(~7 hr)

- Fundamental parameters of X-ray telescopes
- *Chandra* and *XMM-Newton* tutorials
- Tools for X-ray spectral analysis (XSPEC)
- Statistics applied to high energy

Tutorials
(~9-10 hr)

- Presentations of the projects
→ student's choice (with some 'rules')

(~1.5 hr)

+

About two weeks of tutorials+data analysis for all

X-ray laboratory: data analysis hands-on

Remote computers will be made available to students.
Possibly, bring also laptops with X-ray software installed

22.02: h14-18 Aula I
23.02: h14-18 Aula B - Via della Beverara
24.02: h14-18 Aula H
25.02: h14-18 Aula M
26.02: h9-18 Aula L

Lessons + Tutorials + project presentation
Start of data analysis on Friday afternoon?

01.03: h14-18 Aula I
02.03: h14-18 Aula B - Via della Beverara
03.03: h14-18 Aula H
04.03: h14-18 Aula M
05.03: h9-18 Aula L (afternoon: optional)

Data analysis – Week I

08.03: h14-18 Aula I
09.03: h14-18 Aula B - Via della Beverara
10.03: h14-18 Aula H
11.03: h14-18 Aula M
12.03: h9-11 Aula L
h14-18 Aula L (afternoon: optional)

Data analysis – Week II

X-ray laboratory: data analysis hands-on

22.02: h14-18 Aula I

- C. Vignali	Introduction to the X-ray Lab course	30m
- M. Dadina	Fundamental parameters of X-ray telescopes	60m
- P. Grandi	Physics of Radio-Loud AGN	120m

23.02: h14-18 Aula Via della Beverara

- M. Cappi	Physics of Radio-Quiet AGN	120m
- V. Fioretti	Technological development: Athena and CTA as case studies	60m

24.02: h14-18 Aula H

- C. Vignali	Chandra tutorial	120m
- C. Vignali	Statistics	45m

25.02: h14-18 Aula M

- C. Vignali	Demographics and evolution of AGN	120m
- C. Vignali	XSPEC tutorial	90m

26.02: h9-18 Aula L

- E. Torresi	XMM-Newton tutorial	120m
- AA. VV.	Available X-ray projects	90m
	Software setup and start of X-ray data analysis?	

I week

II week

- 01.03: h14-18 Aula I
- 02.03: h14-18 Aula B - Via della Beverara
- 03.03: h14-18 Aula H
- 04.03: h14-18 Aula M
- 05.03: h9-18 Aula L (afternoon: optional)

III week

- 08.03: h14-18 Aula I
- 09.03: h14-18 Aula B - Via della Beverara
- 10.03: h14-18 Aula H
- 11.03: h14-18 Aula M
- 12.03: h9-11 Aula L
- h14-18 Aula L (afternoon: optional)

X-ray laboratory: groups and projects

54 students: 18 groups × 3 students each

Group	Cognome	Nome	Email	Matricola	P/R
1	Alvarez	Deimer	deimer.alvarezgaray@studio.unibo.it	939672	P
	Balboni	Marco	marco.balboni6@studio.unibo.it	930685	P
	Sartori	Simone	simone.sartori5@studio.unibo.it	929048	P
2	Fontana	Samuele	samuele.fontana@studio.unibo.it	953167	P
	Ricci	Gaetano	gaetano.ricci3@studio.unibo.it	950574	P
	Zallio	Luigi	luigi.zallio@studio.unibo.it	951545	P
3	Castellani	Agnese	agnese.castellani@studio.unibo.it	932857	R
	Rossi	Elisabetta	elisabetta.rossi17@studio.unibo.it	931891	P
	Stabellini	Luca	luca.stabellini@studio.unibo.it	953943	R
4	Cantarella	Sebastiano	sebastian.cantarella@studio.unibo.it	926458	P
	Evola	Chiara	chiara.evola@studio.unibo.it	938939	P
	Pizzichemi	Francesco	francesco.pizzichemi@studio.unibo.it	951048	P
5	Baroni	Giulia	giulia.baroni8@studio.unibo.it	952710	P
	Braia	Laura	laura.braia@studio.unibo.it	928063	R
	Cantari	Marcello	marcello.cantari@studio.unibo.it	951147	R
6	Bronzini	Ettore	ettore.bronzini@studio.unibo.it	946804	P
	Bruno	Benedetta	benedetta.bruno3@studio.unibo.it	928732	P
	Troviso	Gabriele	gabriele.troviso@studio.unibo.it	919801	P
7	Bartolini	Chiara	chiara.bartolini9@studio.unibo.it	926366	P
	Lavriani	Luigi	luigi.lavriani@studio.unibo.it	946875	R
	Mastromarino	Claudio	claudio.mastromarino@studio.unibo.it	951085	R
8	Iavertino	Alessia	alessia.iavertino@studio.unibo.it	944887	P
	Moscioni	Arianna	arianna.moscioni@studio.unibo.it	943027	P
	Tropeano	Filippo	filippo.tropeano@studio.unibo.it	949549	R
9	Di Federico	Laura	laura.difederico@studio.unibo.it	920224	P
	Marcuzzo	Elena	elena.marcuzzo@studio.unibo.it	946565	P
	Sotira	Stefano	stefano.sotira@studio.unibo.it	908450	P
10	Barbani	Filippo	filippo.barbani@studio.unibo.it	939837	P
	Billi	Alex	alex.billi@studio.unibo.it	949689	P
	Zaccardi	Angelo	angelo.zaccardi@studio.unibo.it	940542	P
11	Marras	Michele	michele.marras@studio.unibo.it	936996	P
	Rosignoli	Luca	luca.rosignoli2@studio.unibo.it	919995	R
	Travaglini	Francesco	francesc.travaglini3@studio.unibo.it	927746	R
12	Bartolini	Vieri	vieri.bartolini@studio.unibo.it	929185	P+R
	Bigi	Patrick	patrick.bigi@studio.unibo.it	954034	P
	Pacicco	Mattia	mattia.pacicco@studio.unibo.it	940077	P
13	Rosselli	Damiano	damiano.rosselli@studio.unibo.it	927443	P
	Tonti	Filippo	filippo.tonti@studio.unibo.it	942884	P
	Tallone	Domizia	domizia.tallone@studio.unibo.it	951534	P
14	Casadei	Samantha	samantha.casadei@studio.unibo.it	928323	P
	Ferrini	Agnese	agnese.ferrini@studio.unibo.it	951100	R
	Marchetto	Alina	alina.marchetto@studio.unibo.it	923533	P
15	Bottoni	Diego	diego.bottoni@studio.unibo.it	947045	R
	Falchieri	Alberto	alberto.falchieri@studio.unibo.it	932782	P+R
	Righetto	Nicola	nicola.righetto@studio.unibo.it	926142	R
16	Cau	Massimo	massimo.cau@studio.unibo.it	906444	R
	Dodero	Filippo	filippo.dodero@studio.unibo.it	953974	P
	Romiti	Giacomo	giacomo.romiti@studio.unibo.it	949652	P
17	Amatori	Nicola	nicola.amatori@studio.unibo.it	944792	P
	Calzolari	Marco	marco.calzolari3@studio.unibo.it	836761	P
	Zanetti	Andrea	andrea.zanetti8@studio.unibo.it	951306	P
18	Nicolosi	Pierpaolo	pierpaolo.nicolosi@studio.unibo.it	978281	R
	Panbianco	Gabriele	gabriele.panbianco2@studio.unibo.it	935590	R
	Scanu	Antonio	antonio.scanu@studio.unibo.it	999594	R

X-ray laboratory: groups and projects

54 students: 18 groups, 3 students each

Test	Target	Goal	Data
1	Pictor A	Nucleus + Eastern Lobe	XMM
2	Pictor A	Jet + hotspot	Chandra
3	PKS 1510-089	Nucleus/Jet/Knots	Chandra (AGILE)
4	NGC 3782	Nucleus, two states	XMM
5	NGC 5135	Nucleus + SF	Chandra/NuSTAR
6	CDFS	Mosaic/catalog/ obscured AGN	Chandra

1. Each X-ray lab test consists of a mandatory and an optional part
2. Each group chooses one X-ray lab test. At least two groups on the same data, and not more than four groups on the same topic

X-ray laboratory webpage

Lessons, Tutorials, Bibliography, threads, links to X-ray software + useful stuff...

X-RAY LABORATORY 2021

22 February 2021 to 12 March 2021

Europe/Rome timezone

HOME

TIMETABLE

FRONTAL LESSONS

TUTORIALS

EXERCISES

SOFTWARE

USEFUL LINKS

TEACHERS

BIBLIOGRAPHY

****WELCOME TO X-RAY LABORATORY 2021****

OAS-Bologna, in collaboration with the [Department of Physics and Astronomy of the University of Bologna \(DIFA\)](#), organizes combined seminars/laboratories, investigating a broad range of astronomical systems through detection and analysis of their X-ray emission and other radiation they emit.



The laboratory runs for three weeks (22 February-12 March 2021). Students, working in small groups, are introduced to the current problematics of supermassive black holes in order to contextualize their X-ray data analysis exercises. The X-ray laboratory also offers the opportunity to gain first-hand experience with the basic instrumentation tools of modern X-ray astronomy. . At the end of the tutorial, students summarize the laboratory experience in a power-point presentation organized as a professional communication to an Astrophysical Conference.

X-ray Lab is part of the [Astrophysics Laboratory course](#) of DIFA Bologna.

Image credit: Dana Berry/SkyWorks/NRAO/NFS



Design: E. Torresi

<https://indico.ict.inaf.it/event/1365/>

Lessons,
Tutorials,
Bibliography,
useful Links

Lab-X AA2020-21

22.02: h14-18 Aula I

- C. Vignali *Introduction to the X-ray Lab course* (30m)
- M. Dadina *Fundamental parameters of X-ray telescopes* (60m)
- P. Grandi *Physics of Radio-Loud AGN* (120m)

23.02: h14-18 Aula B - Via della Beverara

- M. Cappi *Physics of Radio-Quiet AGN* (120m)
- V. Fioretti *Technological development: Athena and CTA as case studies* (60m)

24.02: h14-18 Aula H

- C. Vignali *Chandra tutorial* (120m)
- C. Vignali *Statistics in a nutshell* (45m)

25.02: h14-18 Aula M

- C. Vignali *Demographics and evolution of AGN* (120m)
- C. Vignali *XSPEC tutorial* (90m)

26.02: h9-18 Aula L

- E. Torresi *XMM-Newton tutorial* (120m)
- AAVV *Available X-ray projects* (90m)

Software setup and start of X-ray data analysis

USEFUL LINKS

XMM-Newton (SAS)

- [XMM-Newton ABC Guide](#)
- [SAS Users Guide](#)
- [XMM-Newton threads](#)
- [XMM-Newton Users Handbook](#)
- [XMM-Newton pile up:](#)

Chandra (CIAO)

- [Introduction to CIAO](#)
- [Science Threads](#)
- [The Chandra ABC Guide to Pileup](#)

NuSTAR

- [NuSTAR link](#)

ds9

- [SAOImage DS9 Users Manual](#)

XSPEC

- [XSPEC on-line manual](#)

Other useful links

1. [Conversion table](#)
2. [Energy conversion](#)
3. [F-test](#)
4. [DeltaChi square distribution for a given number of dof and a given value of P](#)
5. [Calculation of the logarithmic error bars](#)

Presentation of students' work and Exams. I

- ❑ X-ray module exam: powerpoint presentation, one per group, **one week after the end of the lab?**
- ❑ Evaluation: XX/30, to be 'averaged' with the optical/VLA(ALMA)
- ❑ Communication to the students at the end of the X-ray lab exams
- ❑ Students can either accept the final vote ('average' of the three labs) or decide to go with an oral examination. In this optional case, previous votes are not considered anymore
- ❑ Evaluation based on content/presentation/commitment/language

Presentation of students' work and Exams. II

1. About 10 minutes/student. Questions are typically at the end of each of the sub-parts of your presentation
2. The number of slides is indicatively 1 slide/minute. You must select what you want to show us and your main results (not everything!)
3. Prepare your presentation in such a way that it can be easily sub-divided into 3 sub-parts
4. We will randomly decide who is presenting what in each presentation
5. You can prepare hidden slides to be used just in case you want to properly answer to one of our questions
6. Avoid too many animations
7. It is fundamental that you **introduce the source in a broad scientific context** (i.e., what is the principal science problem that you may want to address), **identify the main points of the process of data analysis and interpretation** (within the available time) and that you are **fully prepared on these issues**

Presentation of students' work and Exams. III

RECAP

- Scientific problem and goals of the project
- Presentation of the source and its main properties
- Data available (having in mind the main characteristics of the adopted instruments)
- Data analysis
- Presentation of the results and discussion

Remember: each student should take part to the project (data analysis, discussion of the results, and final presentation)

We will decide who (within each group) is presenting each part of the presentation

Web page – Astrophysics Lab course

<https://www.unibo.it/sitoweb/cristian.vignali/>



Didattica



16297 – Laboratorio di Astrofisica – 10 cfu

Avvisi:

<https://www.unibo.it/sitoweb/cristian.vignali/avvisi>

Lessons/Tutorials:

Virtual Learning Environment +

X-ray Lab webpage: <https://indico.ict.inaf.it/event/1365>

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