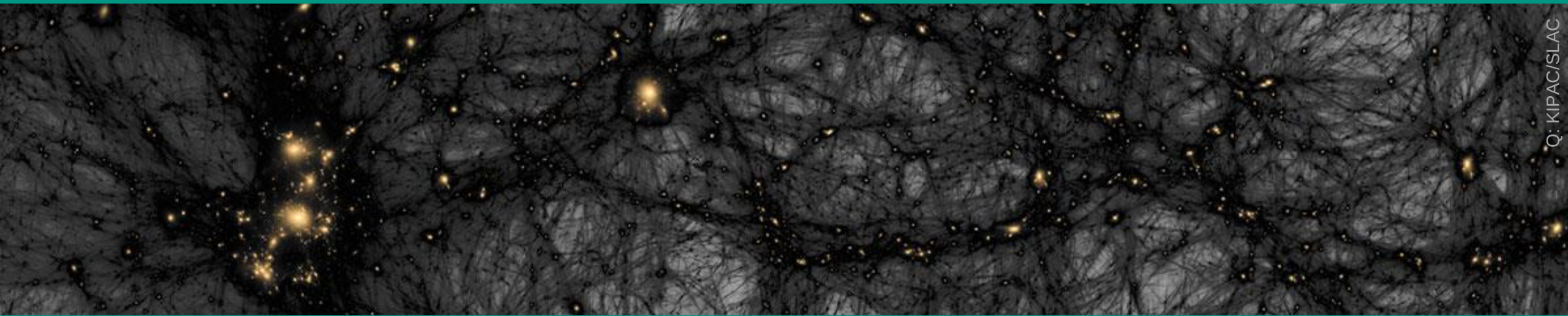


Astroparticle physics *I* – Dark Matter

Winter term 23/24

Organization

Oct. 25, 2023



Q: KIPAC/SLAC

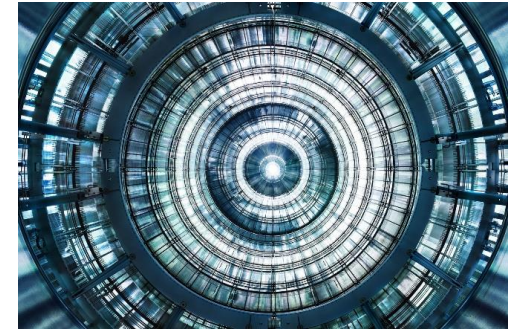
Astro *P*article *P*hysics – your team

■ Lecturer: Guido Drexlin

Professor for particle astrophysics

Institute of Experimental Particle Physics (*ETP*)

research: **neutrinos** (*KATRIN*), **dark matter** (*DARWIN*)



■ further information (writing an **email** is faster than regular office hours)

guido.drexlin@kit.edu

Tel.: **0721 – 608 23534**

admin support:

marion.behechti@kit.edu

office at *CN*:

Building **402** room **212**

office at *CS*:

Building **30.22** room **F2 – 34**



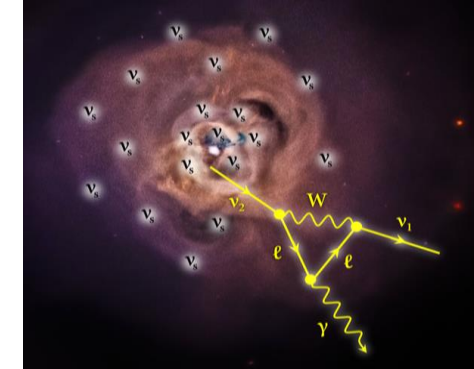
Astro *P*article *P*hysics – your team

■ Main tutor / organiser: Anton Huber

researcher on *KATRIN/TRISTAN*

Institute for Astroparticle Physics (*IAP*)

research: **neutrinos** (*KATRIN*), **detectors** (*TRISTAN*)



■ further information

anton.huber@kit.edu

Tel.: 0721 – 608 26708

office at *CN*:

Building 402 room 214



■ Your tutors

Shailaja Mohanty, Jaroslav Štorek, Nathanael Gutknecht

Astro *P*article *P*hysics – your lecture dates

■ Lecture series – in presence at *kl.HS A* (Physik *HS Nr. 3*)

- zoom channel (in case you cannot attend) <https://zoom.us/j/8364874316>

Wednesday 14:00 – 15:30 (each 2. week, alternating with exercises)

Thursday 11:30 – 13:00 (each week)

■ Lecture dates: 23 lectures (3 SWS)

25.10./ 26.10./

02.11./ 08.11./ 9.11./ 16.11./ 22.11./ 23.11.

30.11./ 06.12./ 07.12./ 14.12./ 20.12./ 21.12.

11.01./ 17.01./18.01./ 25.01./31.01.

01.02. / 08.02./ 14.02./ 15.02.

2023

2024

■ Tutorials: the basics & the details

- sign up via *ILIAS* (central hub, also for distribution of task sheets)
- we expect you to be present at **all tutorials** (Physik *HS Nr. 3*, *kl. HS A*)
- no credits in case of unexcused absence
- two (sub–) blocks of tutorials: **Sheets 1 – 3** & **Sheets 4 – 6**
dates: 15.11. / 29.11. / 13.12. / 10.01. / 24.01. / 07.02.
- we expect you to have worked on a fraction of **60 %** of all tasks in each the two sub–blocks ‘**in earnest**’
- we expect you to have **presented the solution to at least 1 task**

Astro Particle Physics – ILIAS

■ **central hub** for all relevant materials, discussions, topical events ...



4022011 – Astroparticle Physics I: Dark Matter

The lecture gives an overview of current topics in experimental astroparticle physics with a focus on the exp. Search for Dark Matter. Other topics include cosmic rays and neutrino physics and the search for very rare processes beyond the Standard Model. The language is English.



Discussion Forum

If you have organisational questions or questions about the content of the lecture and exercise, this is an opportunity to ask them.

Beiträge (Ungelesen): 1 (1) Neue Beiträge: 1

Letzter Beitrag: [Hi, I am participating in this lecture...](#) von uyih, Gestern, 20:31



Lectures

Here you find the pdf-copies of all lectures.



Exercises & Tutorials

Here you can find the problem sheets.



Solutions (only visible for tutors)

Please don't hand out the solutions to students.

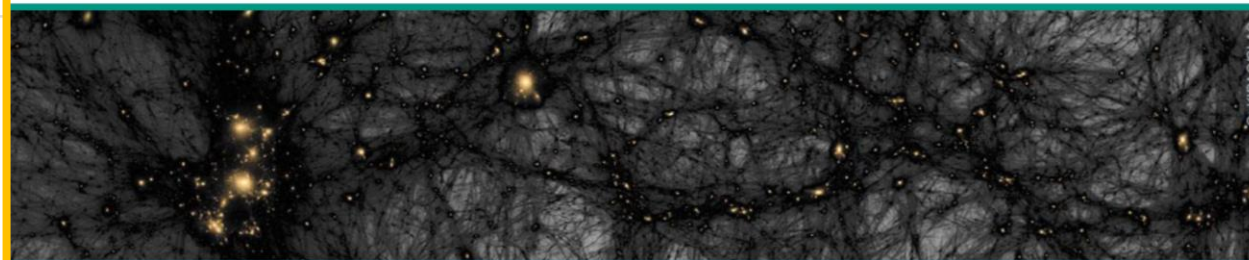


Astroparticle physics I – Dark Matter

Winter term 23/24

Lecture 1

Oct. 25, 2023



KIT – The Research University in the Helmholtz Association

www.kit.edu

the master curriculum at *KIT*

■ astroparticle physics: an **ideal topic** for your master studies

Sem	Physikalisches Schwerpunktfach und Masterarbeit	Physikalisches Er- gänzungsfach	Physikalisches Ne- benfach	Praktika	Nichtphysik. Wahlpfl.fach	Überfachliche Quali- fikationen	LP
1	Module des Physik. Schwerpunktfachs 8	Module des Physik. Ergänzungsfachs 8	Module des Physik. Nebenfachs* 8	Fortgeschrittenen- praktikum* P4 6			30
2	Module des Physik. Schwerpunktfachs 12	Module des Physik. Ergänzungsfachs 6			Module des Nicht- physik. Wahlpfl.fachs* 8	ÜQ - überfachl. Qua- lifikationen* 4	30
3	Spezialisierungs- phase 15 Einf. wiss. Arbeiten 15	participate in world–leading <i>ATP</i> – experiments: <i>KATRIN, XENON – nT, IceCube, Auger, ...</i>					30
4	Masterarbeit 30						30

**Modulhandbuch
Physik Master 2015 (Master of Science)**
SPO 2015
Wintersemester 2022/23
Stand 16.08.2022

KIT-FAKULTÄT FÜR PHYSIK



KIT – Die Forschungsuniversität in der Helmholtz-Gemeinschaft

www.kit.edu

AstroParticlePhysics – the master curriculum

■ the curriculum of ATP at KIT: my lecture programme

Astroparticle Physics – I

Winter term 23/24

Introduction & Overview,
Cosmic Rays, Gammas,
Neutrinos, **Dark Matter**



ATP – II: Particles & Stars

Summer term 2024

ν –properties, stellar evolution,
supernovae & compact objects,
multi–messenger methods



Introduction to Cosmology

Winter term 23/24

Big Bang, cosmological
models, evolution of structure
in the universe, dark universe



AstroParticlePhysics – the master curriculum

■ all courses

Veranstaltungen	WS 22/23	Reg.	SWS	ECTS	SF/EF	NF
Astroteilchenphysik I <i>Astroparticle Physics I</i>	✓	WS	v3u1	8	A	✓
Einführung in die Kosmologie <i>Introduction to Cosmology</i>	✓	WS	v2u1	6	B	✓
Moderne Methoden der Datenanalyse (mit/ohne erw. Übungen)* <i>Modern Methods of Data Analysis (with/without ext. exercises)</i>		SS	v2p4/v2p2	8/6	C	✓
Elektronik für Physiker <i>Electronics for Physicists</i>	✓	WS	v4p4	10	D	✓
Elektronik für Physiker: Analogelektronik <i>Electronics for Physicists: Analog Electronics</i>	✓	WS	v2p2	6	E	✓
Elektronik für Physiker: Digitalelektronik <i>Electronics for Physicists: Digital Electronics</i>	✓	WS	v2p2	6	F	✓
Beschleunigerphysik (mit/ohne erw. Übungen) <i>Accelerator Physics (with/without ext. exercises)</i>	✓	WS	v4u1/v4u0	8/6		✓
Messmethoden und Techniken der Experimentalphysik (mit/ohne erw. Übungen) <i>Measurement Methods and Techniques in Experimental Physics (with/without ext. exercises)</i>			v2u1p2/v2u1	8/6		✓
Detektoren für Teilchen- und Astroteilchenphysik (mit/ohne erw. Übungen) <i>Detectors for Particle and Astroparticle Physics (with/without ext. exercises)</i>	✓	WS	v2p4/v2p2	8/6		✓
weitere Veranstaltungen	WS 22/23	Reg.	SWS	ECTS	SF/EF	NF
Astroteilchenphysik II – Kosmische Strahlung (mit/ohne erw. Übungen) <i>Astroparticle Physics II – Cosmic Rays (with/without ext. exercises)</i>	✓	WS	v2u2/v2u1	8/6	G	✓
Astroteilchenphysik II – Gamma Rays and Neutrinos (mit/ohne erw. Übungen) <i>Astroparticle Physics II – Gamma Rays and Neutrinos (with/without ext. exercises)</i>		SS	v2u2/v2u1	8/6	H	✓
Astroteilchenphysik II – Teilchen und Sterne (mit/ohne erw. Übungen) <i>Astroparticle Physics II – Particles and Stars (with/without ext. exercises)</i>		SS	v2u2/v2u1	8/6	I	✓
Allgemeine Relativitätstheorie <i>General Relativity</i>			v3u2	10 (T)		✓
Computational Methods for Particle Physics and Cosmology <i>Computational Methods for Particle Physics and Cosmology</i>	✓		v2u1	6 (T)	J	✓
Moderne Methoden der Spektroskopie: Anwendungen in der Astroteilchenphysik** <i>Modern Methods of Spektroskopy: Applications in Astroparticle Physics</i>	✓	WS SS	5 Tage Blockpraktikum	2		✓

Astro *P*article *P*hysics – join our advanced seminar

■ deepen your presentation skills with a 45 *min.* seminar in *D*, *GB* ...

- topics focused on **experimental astroparticle physics** & **cosmology**:
 - neutrino properties (mass), evidences & direct searches for dark matter, ...
 - cosmic rays, neutrino astronomy, gravitational waves, ...
 - *CMB*, compact objects,...
- a **one–week block seminar at CN (IAP, B401)** (end of semester)
- **3 talks/day**, plus discussions, coffee breaks,...
- plus: preparation of **posters** (win a poster prize!)



Astro *P*article *P*hysics – the master curriculum

■ the curriculum of *ATP* at *KIT*: *SPF* or *EF*

- **Schwerpunktfach (*SPF*)** / **Ergänzungsfach (*EF*)**
[**major/main subject**] [supplementary subject]



20 ECTS



12 ECTS

- also possible: subsidiary subject (Nebenfach)
- mandatory courses for *SPF/EF*:

either/ **Astroparticle Physics I (Astroteilchenphysik I)**
or **Introduction to Cosmology (Kosmologie)**

Astro *P*article *P*hysics – the master curriculum

■ the curriculum of *ATP* at *KIT*: *SPF* or *EF*

- | | | |
|---------------------------------------|---|------------------------------|
| - Schwerpunktfach (<i>SPF</i>) | / | Ergänzungsfach (<i>EF</i>) |
| [major/main subject] | | [supplementary subject] |



20 ECTS



12 ECTS

■ **Major subject (Schwerpunktfach, *SPF*)** / suppl. Subject (*EF*)

- oral examination ~ **45 – 50 min.** / ~ 30 – 45 min.
 - cross–module topics (modulübergreifend)
 - **2nd** examiner can be selected from specific lecture you have attended (e.g. electronics, detectors,...)