HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

PAP301 Seminars in Particle Physics and Astrophysical Sciences

5 ECTS course 2025-2026

https://www.mv.helsinki.fi/home/osterber/Paras_seminars/

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Goals & outcomes of the course

- Develop your **oral & writing skills** in scientific contexts of your own specialisation (”presentation skills”) in English
- Develop your **peer-reviewing skills** (”feedback”) in English
- Develop your ability to **promote your expertise and market yourself** (”career development”) in English

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- **Plan your MSc thesis** & start writing it (if not already on-going, autumn 2025)
- **Make a MSc thesis disposition** (autumn 2025)
- **Prepare & give oral presentation** related to MSc thesis subject (spring 2026, first oral presentations already in Nov-Dec 2025?)
- **Prepare abstract of oral presentation** (spring 2026, Nov-Dec 2025?)
- **Give feedback** to your fellow students on career related task(s), oral presentation itself & its material (autumn 2025 & spring 2026)
- **Career related lectures/webinars & task(s)** (spring 2026)

Course plan

Gatherings:

- ✓ Period I-II: Wednesday 14-16 in lecture room Exactum CK107
  Get-to-gethers only occassionally, email sent in advance.

  Preliminary dates for autumn: Wed 15.10, Wed 19.11 and Wed 10.12.
- ✓ Period III-IV: Wednesday 14-16 in lecture room Exactum CK107
  Regular presentations mostly every week, email sent in advance.
- ✓ Career related lectures/webinars (spring, date & time to be fixed)

Course homepage:
https://www.mv.helsinki.fi/home/osterber/Paras_seminars/

Autumn 2025: focus on starting and planning of MSc thesis

Spring 2026: focus on the preparation & giving of oral presentation (+ giving of feedback) as well as career related lectures & tasks

Course requirements

Course requirements:

- ✓ Make MSc thesis supervision agreement (if not yet done, autumn)
- ✓ Complete thesis disposition exercise (autumn)
- ✓ Make career development related tasks (spring)
- ✓ One page abstract of seminar topic (spring, Nov-Dec?)
- ✓ Giving of a 25 minutes seminar (spring, Nov-Dec?)
- ✓ Act as opponent & mentor to seminar presentation at least twice (spring, Nov-Dec?)
- ✓ Min. 80 % attendance of seminars & career lectures/webinars (spring, Nov-Dec?)

New for 2025-26

Course assessment

Changed for 2025-26

Course assessment

(based on oral presentation, grading 0-5, same as PHYS4006):

- ✓ 20 % timing (providing abstract 1 week in advance & slides 2 days before presentation and keeping the 25 min presentation time)
- ✓ 20 % abstract (descriptive & compact title, clarity & readability, language and correspondence to presentation)
- ✓ 25 % presentation material (adaptation to target group, structure of presentation, clarity of slides, suitability & readability of pictures, figures, formulas & tables)
- ✓ 25 % presentation itself (contact & interaction with audience, audible voice and suitable pace)
- ✓ 10 % acting as opponent (constructive feedback, general assessment, detailed feedback, abstract vs presentation)

Use of generative AI

Use of generative AI:

✓ On the course we follow the general rules of University of Helsinki: https://studies.helsinki.fi/instructions/article/using-ai-support-learning

✓ Usage of Large Language Models (LLMs) is encouraged (when suitable for the task(s) to be completed)

✓ Usage of LLM's should be clearly stated including how LLM's were used

✓ Recommended to use the LLM provided by the university to students: Copilot (or CurreChat if you have access).
Instructions:
https://helpdesk.it.helsinki.fi/en/instructions/information-security-and-cloud-services/cloud-services/generative-ai-university

MSc thesis

More details & useful links: ParAs programme moodle page
https://moodle.helsinki.fi/course/view.php?id=45534

Academic trained person should be able to find facts in reference works and to express his/her thoughts in writing logically and clearly. The MSc thesis will train these skills.

Master thesis: 30 ECTS credits
suggested length ~ 40-50 pages (however field & topic dependent)

MSc thesis work phases:

- ✓ familiarization with reference works
- ✓ independent research work
- ✓ making of a disposition for the thesis
- ✓ thesis writing

} Under the guidance of the supervisor

How find a thesis subject and a supervisor ?

If you don't have a clear idea about your thesis topic and supervisor, discuss with your academic mentor or course lecturers as soon as possible. They can guide you to a research group that matches your interests.

For **MSc thesis topics in astronomy**, please visit
https://moodle.helsinki.fi/course/view.php?id=15592

Webpages of research groups in space physics & quantum computing

- ✓ **Space physics research:** https://blogs.helsinki.fi/spacephysics/ (contact: E. Kilpua, A. Osmane, M. Palmroth or L. Turc)
- ✓ **Quantum computing:** https://www.helsinki.fi/en/researchgroups/helteq (contact: S. Maniscalco)

How find a thesis subject and a supervisor ?

Contacts & webpages of research groups in particle physics & cosmology

- ✓ **Experimental particle physics** (CERN & Large Hadron Collider): https://www.hip.fi/research/cms-programme/ (contact: M. Voutilainen or K. Österberg)
- ✓ **Detector laboratory for particle physics instrumentation** (radiation detectors): https://www.hip.fi/detector-laboratory/ (contact E. Brücken or M. Kalliokoski)
- ✓ **Theoretical particle physics** (Beyond Standard Model physics): https://www.hip.fi/research/theory-programme/fundamental-particle-interactions-beyond-the-standard-model/ (contact: O. Lebedev or A. Tureanu)
- ✓ **Theoretical cosmology:** https://www.hip.fi/research/theory-programme/theoretical-cosmology/ (contact: S. Räsänen)
- ✓ **Particle cosmology** (dark matter): https://www.helsinki.fi/en/researchgroups/particle-cosmology (contact: K. Tuominen or M. Heikinheimo)
- ✓ **Observational cosmology** (Euclid project): https://www.hip.fi/research/euclid/ (contact E. Keihänen)
- ✓ **Computational field theory:** https://blogs.helsinki.fi/computational-field-theory/ (contact K. Rummukainen, M. Hindmarsh or D. Weir)
- ✓ **Quantum fields, gravity & information:** https://blogs.helsinki.fi/qfgi-group/ (contact: E. Keski-Vakkuri or N. Jokela)
- ✓ **Dense strongly interacting matter:** (contact: A.Vuorinen)

MSc thesis supervision agreement

- Agreement between student & supervisor(s) on defining how to work together
- Made when starting work on the MSc thesis
- At the same time a first MSc thesis planning
- Signed by the supervisor(s) and the student
- Copies distributed to the director of the MSc programme (ParAs: Erik Brücken, TCM: Esko Keski-Vakkuri) and to the study office (Janna Koivisto/kumpula-student@helsinki.fi).
- **Drafting of the agreement is important and it is the student's responsibility.**

NB! People external to University of Helsinki (UH) can be main supervisor but it is good to have at least one UH permanent staff as co-supervisor.

Next: When topic & supervisor known, fill MSc thesis supervision agreement

UNIVERSITY OF HELSINKI
MASTER'S PROGRAMME IN PARTICLE PHYSICS AND ASTROPHYSICAL SCIENCES

UNIVERSITY OF HELSINKI
FACULTY OF SCIENCE

MSc thesis supervision agreement
☐ **New agreement**
☐ **Updated agreement**

Name of the student:	
Student number:	
E-mail and telephone:	
Study track:	

Supervision:

Supervisor(s): O.O. (UH PARAS) and N. N. (organization)	

Please outline below the supervision process taking into account at least the following aspects:
- distribution of responsibilities between student and supervisor(s)
- planned frequency of supervision meetings
- timeframe submitting materials before supervision meetings (if applicable)
- timeframe for receiving comments from the supervisor(s) after submitting material
- ways of contacting the supervisor between agreed meetings

Topic of the thesis (preliminary title):

Research question of the thesis:

If the research question is not specified yet, please outline the process how to define the research question and set the date by when the research question will be set.

Study area, materials and methods:

Schedule:[1]

Start time (mm/yy):	
Review of literature (months)	
Experiments / computations (months)	
Analysis of results and writing the thesis (months)	
Finish time (mm/yy)	

Good scientific practice and the ethical principles followed in the field of research:

If applicable:
Research resources: (partners in cooperation, datasets, infrastructure), space arrangements, funding)

If applicable:
Safety introduction and safety measures for experimental work.

If applicable:
Use of and publication of research data: (if specific data is used/produced)

The thesis will be published at the e-thesis platform (HELDA).

Validity of the agreement, problem solving

End date of the validity of the agreement (mm/yy)	
The contact person in case of problems in the supervision and thesis process[2]	

This agreement can be updated anytime during the thesis process by preparing a new agreement. The agreement must be updated after the end date, if the thesis is not finished.

Date and signatures:

Supervisor Student

Distribution: Student, supervisor(s), responsible professor (of the study track), programme director and study office.

Link to template on course homepage:
https://www.mv.helsinki.fi/home/osterber/Paras_seminars/

Deadline: Mon 13.10.2025

[1] One of the expected learning outcomes of master's thesis is to learn to conduct project work, which includes keeping the schedule. This is reflected also in the evaluation matrix.

[2] The primary contact person is the director or vice director of the master's programme. The contact person can not be a supervisor of the thesis.

(Typical) structure of MSc thesis

See e.g. https://sokogskriv.no/en/writing

- ✓ Abstract/summary
- ✓ Foreword (optional)
- ✓ Introduction
- ✓ Theory (optional, theory can be included in introduction)
- ✓ Methods
- ✓ Results/analysis
- ✓ Discussion and Conclusion (separate or together)
- ✓ List of references: apply reference convention of physics field
  + either in alphabetic order with year e.g. [Donald2010] …
    or numbered in the order the references occur e.g. [1] …
- ✓ Possible appendices

Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

✓ **Objective and question setting of the thesis**
- Justifying the research topic and its significance
- Defining a clear research question and objective, research problem or theme
- Considering research ethics (also in Data and research method as well as in Reflection and conclusion)

✓ **Scientific framework of the thesis and use of sources**

✓ **Data and research method**

✓ **Presentation of the results of the thesis**

✓ **Reflection and conclusions**

✓ **Thesis as an academic text**

✓ **Working during the thesis process**

https://guide.student.helsinki.fi/system/files/inline-files/ATM PARAS EnCHiL Evaluation matrix_0.pdf

Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
  - Being familiar with relevant research and literature
  - Defining a research perspective and concepts relevant to the problem discussed
  - Using source criticism and orginal scientific sources
  - Analytically examining perspectives presented in the source literature and creating syntheses
- ✓ **Data and research method**
- ✓ **Presentation of the results of the thesis**
- ✓ **Reflection and conclusions**
- ✓ **Thesis as an academic text**
- ✓ **Working during the thesis process**

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Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
- ✓ **Data and research method**
  - Describing the material
  - Selecting an appropriate method to address the research question
  - Describing the method comprehensively (strategy, information retrieval and analysis)
  - Ensuring that the material is sufficient and applicable for the research question and analysis method
- ✓ **Presentation of the results of the thesis**
- ✓ **Reflection and conclusions**
- ✓ **Thesis as an academic text**
- ✓ **Working during the thesis process**

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Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
- ✓ **Data and research method**
- ✓ **Presentation of the results of the thesis**
  - Reporting the results clearly and logically
  - Illustrating the results with appropriate images, diagrams and tables
  - Utility, usability and/or applicability of results
- ✓ **Reflection and conclusions**
- ✓ **Thesis as an academic text**
- ✓ **Working during the thesis process**

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Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
- ✓ **Data and research method**
- ✓ **Presentation of the results of the thesis**
- ✓ **Reflection and conclusions**
  - Discussing how the presented results address the research question
  - Specifying relationship between research results and previous research
  - Presenting new research problems
  - Considering opportunities for applications
  - Drawing thourough, reliable and insightful conclusions
  - Basing the conclusions on the results
- ✓ **Thesis as an academic text**
- ✓ **Working during the thesis process**

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Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
- ✓ **Data and research method**
- ✓ **Presentation of the results of the thesis**
- ✓ **Reflection and conclusions**
- ✓ **Thesis as an academic text**
  - Using a clear structure appropriate for the research approach
  - Using grammatically correct language
  - Documenting sources appropriately and consistently
  - Writing a clear and accurate bibliography
  - Using an appropriate layout
- ✓ **Working during the thesis process**

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Evaluation criteria MSc thesis
(since 1.8.2024, all areas graded 0-5)

- ✓ **Objective and question setting of the thesis**
- ✓ **Scientific framework of the thesis and use of sources**
- ✓ **Data and research method**
- ✓ **Presentation of the results of the thesis**
- ✓ **Reflection and conclusions**
- ✓ **Thesis as an academic text**
- ✓ **Working during the thesis process**
  - Being open-minded and independent
  - Adopting methods and solving problems creatively
  - Completing the thesis in the planned timetable
  - Ability to interact/collaborate with the supervisor and (if relevant) with other members of the research team

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MSc thesis evaluation matrix
(since 1.8.2024, all areas graded 0-5)

	0	1	2	3	4	5
1. Objective and question setting of the thesis • Justifying the research topic and its significance • Defining a clear research question and objective, research problem or theme • Considering research ethics	The research question and its significance has not been explained at all. The objective is missing or not understandable.	The research question and its significance have not been explained or motivated clearly. The objective or topic area of the work has not been fully understood, or it is not apparent when reading the work.	The research question and its significance are vaguely defined. The objective is unspecific. There may be problems with outlining or delimiting the research area.	The objective of the thesis, the research question and its significance are presented clearly.	The research question and its significance are very clear and described in appropriate detail. The objective is well outlined with a focus on the essential.	The objective of the thesis, research topic and question as well as their significance are presented in an excellent manner.
2. Scientific framework of the thesis and use of sources • Being familiar with relevant research and literature • Defining a research perspective and concepts relevant to the problem discussed • Using source criticism and original scientific sources • Analytically examining perspectives presented in the source literature and creating syntheses	The work shows lack of familiarity with the research area. The reference material is absent, or has not been used in an appropriate way.	The work shows significant shortcomings in the knowledge of the research area. Some reference material has been used, but the references are irrelevant, or of inadequate quality.	The work shows limited knowledge of the research area. Reference material has been used, but its scope is limited or not fully relevant. Critical assessment of the reference material is largely missing.	The work shows familiarity with the research area through background literature. The reference material is relevant and its scope is appropriate. The topic and reference material has been mainly analysed critically.	The work shows good command of the research area. Comprehensive reference material of good quality. The topic and reference material has been analysed critically.	Excellent in-depth command of the research area, based on high quality scientific reference material. Discussion proving excellent understanding and critical maturity.
3. Data and research method • Describing the material • Selecting an appropriate method to address the research question • Describing the method comprehensively (strategy, information retrieval and analysis) • Ensuring that the material is sufficient and applicable for the research question and analysis method • Considering research ethics	Data, methods or analysis are inadequate for the research question.	Significant shortcomings in choice of methods, data, or analysis.	The research methods and data used in the work are mainly adequate, but the work contains some problems or inconsistencies in the choice of data, methods or analysis.	The research methods and data are suitable for the problem, and their choice is well argued. The analysis is mainly justified.	Good and well-argued use of research methods and data, clearly based on scientific literature or tradition. The analysis is well justified.	Excellent selection of research data and methods. The analysis is excellent.

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MSc thesis evaluation matrix
(since 1.8.2024, all areas graded 0-5)

	0	1	2	3	4	5
4. Presentation of the results of the thesis • Reporting the results clearly and logically • Illustrating the results with appropriate images, diagrams and tables • Utility, usability, and/or applicability of results	The results of the thesis are not presented in an understandable manner.	Significant shortcomings in all areas of reporting the results.	The work shows some concept of reporting research findings, but clear shortcomings in communicating them logically. There are some shortcomings in use of pictures, figures, or tables.	The findings have mainly been reported in a clear and logical way. The use of pictures, figures, and tables is good and mostly supports the analysis of the results.	The findings are reported in a clear and logical way. The use of pictures, figures, and tables supports the analysis of results. Further applicability of results is presented.	The reporting of findings and use of pictures, figures, and tables is well considered and apt. The findings are applicable in further research and/or industrial application. The results have potential for publishing.
5. Reflection and conclusions • Discussing how the presented results address the formulated research questions • Specifying the relationship between the research results and previous research • Presenting new research problems • Considering opportunities for applications • Considering issues of research ethics • Drawing thorough, reliable and insightful conclusions • Basing the conclusions on the results	Conclusions and discussion are missing.	Conclusions and discussion do not address the research question. Understanding the significance of the results is not demonstrated.	Conclusions and discussion mostly address the research question. The work shows the writer's own input. It remains unclear if the significance of the results is understood.	Conclusions and discussion address the research question and are feasible. The writer's own input is evident in the conclusions and discussion of results. The significance of the findings has been demonstrated.	Conclusions and discussion clearly address the research question and the significance of the results. The writer's own input is evident and insightful.	Conclusions and discussion are clear and thorough, discussing how generalizable the findings are. The writer's own input is evident and insightful, presenting new research problems or showing opportunities for new applications. The discussion of findings may even show an aptitude for independent, critical, and innovative research.

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MSc thesis evaluation matrix
(since 1.8.2024, all areas graded 0-5)

	0	1	2	3	4	5
6. Thesis as an academic text • Using a clear structure appropriate for the research approach • Using grammatically correct language • Documenting sources appropriately and consistently • Writing a clear and accurate bibliography • Using an appropriate layout	Thesis lacks structure. The text has not been written according to the standards of scientific writing. Citations to references are lacking. The overall style does not conform at all to standard of scientific writing. The figures and equations are irrelevant or poorly connected to the text.	Significant structural deficiencies. The use of the standards of scientific writing and citation technique are deficient. The thesis is not of appropriate length or the requirements on the overall style are not met. The figures and tables in the thesis are of poor quality, lacking or do not support the text. The equations are unclear, unnecessary or wrong, or the symbols are not explained. The thesis contains lots of grammatical errors, lack of preciseness or scientific mistakes.	The thesis structure is appropriate, but the parts are imbalanced. Room for improvement in language and use of references. The figures, tables and equations in the thesis are of sufficient quality and mostly support the text. The thesis contains some grammatical errors, lack of preciseness or scientific mistakes.	The structure of the thesis is good. The thesis conforms largely to the standards of scientific writing. The length is acceptable and the requirements on the overall style are mostly met. The language of the thesis and use of references is appropriate. The figures and tables in the thesis are informative and support the written text. The equations are mostly in balance with the written text. The text is mostly clear and grammatically precise.	The structure of the thesis is good, and the text runs smoothly. The presentation is consistent in style. The use of figures and tables is well justified. The equations are in balance with the written text. Flawless use of references. The whole text is logical and consistent. The text is clear and grammatically precise.	The structure of the thesis is excellent. The thesis conforms to the standards of scientific writing. The length is suitable and the overall style is excellent. The figures and tables in the thesis are prepared well, are informative and support the written text. The equations are sufficient and well balanced with the written text, and all used symbols and acronyms are explained. Language and use of references as well as the overall appearance are exemplary.
7. Working during the thesis process • Being open-minded and independent • Adopting methods and solving problems creatively • Completing the thesis in the planned timetable	Independence and capabilities to collaborate are difficult to assess or inexistent. The completion of the work was not predictable. The thesis took an exceptionally long time to finish.	Independence is largely missing and the thesis proceeds mainly by the decisions and advices of the supervisor. The work schedule was not predictable. The thesis falls significantly behind the planned schedule.	Independence is partly missing. There have been some challenges in the interaction between the student and the supervisor. The work has progressed at varying speeds, which has made supervision challenging.	Some independent thinking during the thesis work. Student interacts actively with the supervisor, but requires often external input for making decisions. Work proceeds mainly in the planned schedule.	Independence in analysis and inspection of the results. Smooth collaboration and/or interaction with the supervisor and other team members (if relevant) during the thesis work. Planned schedule is mostly met.	Creativity and independence in analysis and inspection of the results. Skilled collaboration and/or interaction with the supervisor and other team members (if relevant) during the thesis work. Planned schedule is met.

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Discussion: MSc thesis

15 minutes discussion: Have a discussion regarding the following topics in groups of 3-4 students

- What are your thoughts about the MSc thesis ?
- What subjects are your interested of ?
- How to find a thesis topic & thesis supervisor ?
- How to get started ?
- Any tips that would be good to know for the others ?

After the small group discussions, short reports by each group to the whole room

Next

What is the status of your MSc thesis ?

Do you have a supervisor ?

Is the thesis subject fixed ?

If not discuss with your academic mentor/supervisor !

Make thesis supervision agreement with your thesis supervisor & return it to the Paras seminar Moodle page: https://moodle.helsinki.fi/course/view.php?id=28327

(deadline: **Monday 13.10.2025**)

Next get-together: Wednesday 15.10.2025