

# PAP303 Statistical Inverse Methods

HUOMI! OPINTOJAKSOJEN TIETOJEN TÄYTTÄMISTÄ KOORDINOIVAT KOULUTUSSUUNNITTELIJAT HANNA-MARI PEURALA JA TIINA HASARI

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## 1. Course title

Tilastolliset inversiomenetelmät  
Statistisk inversion metoder  
Statistical Inverse Methods

## 2. Course code

PAP303

Previous codes: 53834 Tilastolliset inversiomenetelmät, 5 cr

## 3. Course status: compulsory

*-Which degree programme is responsible for the course?*  
Master's Programme in Particle Physics and Astrophysical Sciences

*-Which module does the course belong to?*  
PAP300 Advanced Studies in Particle Physics and Astrophysical Sciences (compulsory for Study Track in Astrophysical Sciences)  
ATM300 Advanced Studies in Atmospheric Sciences (optional for Study Track in Meteorology)

*-Is the course available to students from other degree programmes?*  
Yes

## 4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)

Master's level, degree programmes in medicine, dentistry and veterinary medicine = secondcycle degree/EQF level 7  
Doctoral level = third-cycle (doctoral) degree/EQF level 8

*-Does the course belong to basic, intermediate or advanced studies (cf. Government Decree on University Degrees)?*  
Advanced studies

## 5. Recommended time/stage of studies for completion

Recommended time for completion is in the mid-phase of Master's studies.

## 6. Term/teaching period when the course will be offered

Annually in the spring term, periods 3–4.

## 7. Scope of the course in credits

5 cr

## 8. Teacher coordinating the course

University researcher Antti Penttilä.

## 9. Course learning outcomes

You will learn

- Advanced statistical methods to describe and analyze research data
- Theory and practice of statistical estimation and testing
- Multivariate methods
- Monte Carlo statistical techniques
- Bayesian inference
- Statistical inversion using Markov Chain Monte Carlo methods

## 10. Course completion methods

The student must complete weekly exercise tasks, which will include traditional 'pen-and-paper' problems and computer tasks. There will be final exam in the end of the course.

## 11. Prerequisites

MAPU I–III, Scientific Computing I, Havaintojen tilastollinen käsittely

## 12. Recommended optional studies

Scientif Computing II

## 13. Course content

Statistical inference, linear model, nonlinear model, kernel estimation, multivariate methods, Bayesian inference, Monte Carlo methods, MCMC.

## 14. Recommended and required literature

The material is collected to handout that is distributed to students.

## 15. Activities and teaching methods in support of learning

Weekly lectures and exercises.

## 16. Assessment practices and criteria, grading scale

Final grade is based on exercises and final exam.

## 17. Teaching language

English, optionally Finnish