universität wien
Fakultät für Geowissenschaften, Geographie und Astronomie

universität wien
Fakultät für Mathematik

Berufungsvorträge
"Data Science in Astrophysics"

Die Berufungsvorträge schließen folgende Punkte mit ein:

Didaktischer Vortrag (30 Minuten)
Fragen/Pause (10 Minuten)
Wissenschaftlicher Vortrag (40 Minuten)
Fragen/Pause (15 Minuten)
Kommissionelles Hearing -
(Dekanatsbesprechungszimmer, 11. Stock)

Donnerstag, 6. Juni 2019, Sky Lounge, OMP 1

Oliver Hahn
(Laboratoire Lagrange Université / Observatoire Côte d'Azur)

14:00 Uhr: Didaktischer Vortrag

„The formation of the cosmic large-scale structure"

I will give a 30 min lecture module at the advanced bachelor level which could be part of a general course on cosmology or extragalactic astrophysics, or a course on "the Universe" for e.g. math students. In this lecture, I will explain the origin of the large-scale distribution of matter in the Universe, and how it arises from spatially correlated random fluctuations that are produced in the very early Universe. The module will discuss the underlying equations, provide an intuitive understanding based on numerical examples, and link to observations.

14:40 Uhr: Wissenschaftlicher Vortrag

„Cosmological Simulations: at the Crossroads of Cosmology and Astrophysics, Data and Theory"

Cosmology is an exciting field: the biggest current mysteries in physics — the nature of the elusive dark matter and dark energy — meet an unprecedented amount of astronomical data covering most of our Universe's history, and ranging from gamma-ray over visible to radio wavelengths, as well as gravitational waves. Simulations and numerical modelling take a pivotal role in providing key insights into the link between cosmological theory and astronomical observables, as well as the astrophysical processes that shape them. I will present recent progress and ongoing efforts in improving the numerical modelling of both the dark and the luminous side of our Universe. I will also highlight the increasing importance of data-driven approaches to explore and model simulation results, and to create numerical universes "in the cloud".

Freitag, 7. Juni, 2019, HS 9, 1. OG, OMP 1

Robert Feldmann
(University of Zurich)

9:00 Uhr: Didaktischer Vortrag

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9:40 Uhr: Wissenschaftlicher Vortrag

„Why do galaxies stop making stars?“

It has long been known that many massive galaxies in today's Universe show low or vanishing levels of star formation activity. Several promising explanations have been proposed that explain the existence of such passive galaxies, but various theoretical puzzles remain. The theoretical challenge has deepened with recent observations of passive galaxies at earlier times when the Universe was merely a few billion years old. At such times, strong gas accretion from the cosmic environment, as predicted by cosmological simulations, should have sustained a vigorous star formation activity. I will present evidence, based on ultra-high resolution, cosmological simulations, that the star formation activity is driven both by processes operating within galaxies as well as by their cosmological environment. This new perspective aligns well with recent empirical approaches and clarifies the role of internal and external processes in regulating star formation in galaxies.

Freitag, 7. Juni, 2019, HS 11, 2.OG, OMP 1

Elena Giusarma
(Flatiron Institute Center for Computational Astrophysics, New York)

13:00 Uhr: Didaktischer Vortrag

“Cosmological parameter inference with Bayesian statistics”

Cosmologists are interested in studying the origin and evolution of the physical Universe. During the last decade, sky surveys have collected hundreds of terabytes of astronomical data that enclose useful information about our Universe. Statistics is the tool by which we can analyze and extract this information from a wide variety of data. In this talk, I will give a brief overview of statistical techniques that are frequently used in cosmology, focusing on the Bayesian inference analysis. I will provide some useful tool such as Bayesian Theorem, marginalization, and confidence regions. I will then go through the most basic Markov Chain Monte Carlo method for sampling probability density functions, and I will show some practical examples to illustrate the use of such technique.

13:40 Uhr: Wissenschaftlicher Vortrag

“Neutrino Cosmology - Weighing the Ghost Particle with the Universe”

Over the past decades, the high-precision cosmological data have significantly improved our understanding of the Universe, contributing greatly to the establishment of the standard model of cosmology. However these results have also opened new questions in both fundamental physics and astrophysics. One of the great mystery of the universe is that more than 80% of the matter in our Universe is made up of material that is invisible (dark matter). This component has important consequences in the evolution of the Universe and in the structure formation processes. While the major contribution to the dark matter should arise from cold dark matter (CDM), a small component of hot dark matter (HDM) can also be present. A natural candidate for the HDM is neutrino. Neutrinos physics is one of the most fascinating research areas that has stemmed from the interplays between cosmology, astrophysics and particle physics. Cosmology provides an independent tool for the investigation of neutrino properties since it is sensitive to the absolute scale of neutrino masses. Measuring the masses of these particles would be of extreme value to unravel the departure from the Standard Model (SM) of Particle Physics. A robust detection of neutrino masses is among the key goals of upcoming Cosmic Microwave Background (CMB) and Large-Scale Structure (LSS) surveys. In this talk, I will review the main physical effects of massive neutrinos on cosmological observable and summarize recent progress on neutrino mass constraints obtained by combining different cosmological measurements. I will also show a new approach to produce fast non-standard cosmological simulations with massive neutrinos by applying deep learning algorithms.