



## Machine learning in astronomy: “Astroinformatics 2018” conference

The international “Astroinformatics 2018” conference was held in the Studio Villa Bosch, Heidelberg, from September 3–7, 2018. Scientists from all over the world met at the conference to exchange views on the newest and most successful methods of machine learning in an effort to advance the exploration of the Universe. The event was organized by HITS researchers **Dr. Kai Polsterer**, **Antonio D’Isanto**, **Erica Hopkins**, and **Dr. Nikos Gianniotis** (all from the Astroinformatics group) in cooperation with Prof. Joachim Wambsgans (Heidelberg University) and Dr. Coryn Bailer-Jones (Max Planck Institute for Astronomy, Heidelberg, Germany). Among the speakers were machine learning experts Prof. Katharina Morik (TU Dortmund, Germany), Prof. Ray Norris (Western Sydney University, Australia), Prof. George Djorgovski (California Institute of Technology, Pasadena, USA) and Dr. Pavlos Protopapas (Harvard University, USA).

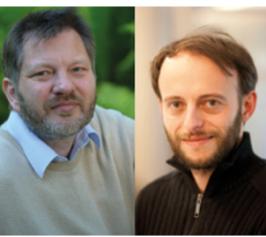


The “Astroinformatics” conference – which is devoted to scientifically exploit the fast-growing volumes of data in astronomy – is one of the most important events in this field. At the conference, scientists discuss topics including novel database systems, visualization and augmented reality, artificial intelligence, and the reproducibility of research results. The conference is hosted once a year at a different location around the world. Thanks to Kai Polsterer (see “Portrait”) and his collaboration partners, the conference was held in Germany for the first time in 2018.



The “Scientific Computing” group (SCO, group leader: Prof. Alexandros Stamatakis) will change their name as of January 1st, 2019: They will be called – adapted to their research fields - “Computational Molecular Evolution” (CME).

### HITS



## “Highly Cited Researchers” at HITS

This year, two HITS researchers again found themselves among the most cited researchers worldwide. The “Highly Cited Researchers” report of 2017 states that the publications of **Prof. Tilmann Gneiting** (CST) and **Prof. Alexandros Stamatakis** (SCO) rank in the top 1 percent of citations in their fields and publication years in the Web of Science. Both scientists have a primary affiliation with HITS, their secondary affiliations being with the Karlsruhe Institute of Technology (KIT).



## School project: Programming from the bottom up

In October 2018, the programming competition “Mathematics and Robotics” was organized at the Ernst-Sigle-Gymnasium in Kornwestheim (Baden-Württemberg). 28 high-school students from grades 9–11 learned to program robots that interact with their environments. HITster **Philipp Gerstner** (DMQ) was a member of the jury that evaluated the results: “The teams performed very well, particularly if you consider that some of the students had no former experience in programming.” HITS supported the event with a donation of 3,000 euros that could be spent – among other things – on the expensive hardware.

## New employees and visiting scientists

**ADMIN:** Frauke Bley, employee

**MCM:** Christina Athanasiou, employee / Alexandros Tsengenes, employee / Lucas Gasparello Viviani, visiting scientist (University of Sao Paolo, Brazil, PhD Student)

**NLP:** Minsu Ko, PhD Fellow / Ivan Sekulic, employee / Mehwish Fatima, visiting scientist (University Faisalabad, Pakistan, DAAD-Fellow)

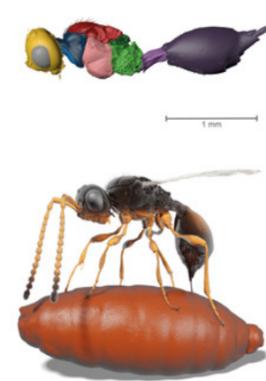
**PSO:** Theodoros Soultanis, visiting scientist (Max-Planck Institute for Astronomy Heidelberg, PhD Student) / Christian Sand, PhD Fellow / Dr. Fabian Schneider, visiting scientist (Gliese-Fellow at Heidelberg University)

**SCO:** Ben Bettisworth, employee / Aggelos Koropoulos, visiting scientist (University of Crete, Greece, PhD Student)

### HITS groups:

Astroinformatics (AIN), Computational Statistics (CST), Data Mining and Uncertainty Quantification (DMQ), Groups and Geometry (GRG), Molecular Biomechanics (MBM), Molecular and Cellular Modeling (MCM), Natural Language Processing (NLP), Physics of Stellar Objects (PSO), Scientific Computing (SCO), Scientific Databases and Visualization (SDBV).

### HITSTERS



## Parasites discovered in fossil fly pupae

Parasitic wasps are known to have existed as early as several million years ago; however, researchers of various disciplines have recently discovered fossil parasites inside their hosts for the first time. The scientists examined fly pupae from old collections using ultrafast X-ray imaging and described four extinct wasp species that had been previously unknown. The insects lived in the Paleogene era, which spanned from circa 66–23 million years ago. Each of the four parasitic wasp species had its own strategy for adaptation to its host. The scientists named the most frequently observed of the four species “Xenomorphia resurrecta.” The genus “Xenomorphia” was named after the creature from the “Alien” science fiction series known as Xenomorph, who also develops endoparasitically.

The fossils the scientists studied – more than 1,500 mineralized fly pupae – belong to collections of the Natural History Museum of Basel and the Naturhistoriska riksmuseet of Stockholm. The results of the project provide critical information on the evolution of parasitism, which is widespread and has a significant impact on ecosystems. Today, about 50% of all animal species are deemed parasites.

### Digital reconstruction with “Biomedisa”

**Philipp Lösel** and **Prof. Vincent Heuveline** (DMQ) developed the algorithms and software for the digital reconstruction and created the online application “Biomedisa” (<https://biomedisa.de>) for the project. The software was developed at the Engineering Mathematics and Computing Lab (EMCL) at the Interdisciplinary Center for Scientific Computing (IWR) of Heidelberg University. The project was coordinated by Dr. Thomas van de Kamp from the Karlsruhe Institute of Technology (KIT). The LWL-Museum of Natural History in Münster and the State Museum of Natural History Stuttgart were among other contributing institutions, and the findings were published in “Nature Communications.”

*“Parasitoid biology preserved in mineralized fossils.” Thomas van de Kamp, Achim H. Schwermann, Tomy dos Santos Rolo, Philipp D. Lösel, Thomas Engler, Walter Etter, Tomáš Faragó, Jörg Göttlicher, Vincent Heuveline, Andreas Kopmann, Bastian Mähler, Thomas Mörs, Janes Odar, Jes Rust, Nicholas Tan Jerome, Matthias Vogelgesang, Tilo Baumbach, & Lars Krogmann. Nature Communications-volume 9, Article number: 3325 (2018)*

### RESEARCH



## Kai Polsterer: “We will revolutionize data access.”

Kai Polsterer loves PINK. Not only does the father of two girls use a pink smartphone, but the research posters of his group “Astroinformatics” are also in bright pink. “At conferences, it’s an eye-catcher, and it triggers good conversations with colleagues.” Kai knows that communication is very important in reaching his goal – to further astronomy with new methods of computer science. And PINK is a software tool that helps astronomers analyze the morphology of galaxies. “We’ve just released a new version,” the 42-year-old researcher explains. Kai Polsterer came to HITS in 2013 as leader of a junior group that was the first of its kind in Europe dedicated to astroinformatics. In the last five years, Kai has guided his group to an established part of the astronomers’ community. “We have become a reference in the field, and one of our 2018 papers has already been cited eleven times.” Kai Polsterer has been the leader of a full group at HITS since September 2018, a career step recommended by an external committee that had evaluated his junior group.

Machine learning has become popular in recent years. “In astronomy, however, know-how is often missing,” Polsterer states. “Therefore, we present the topic to our colleagues via tutorials and other formats like birds of a feather” – for instance, at the “Astroinformatics 2018” conference in September (see “HITS”) or at the ADASS conference in Maryland/USA, from which Kai has just returned. Kai has pursued an interdisciplinary approach: After earning his diploma in computer science at the TU Dortmund, he completed a PhD in physics and astronomy at the University of Bochum (both in Germany).

Kai Polsterer is not only active as a referee and as an invited conference speaker; he also participates in groups that provide sound advice on politics – for example, as speaker of the working group Machine Learning and Infrastructure at the German Physical Society. Moreover, he embraces contact with the public. Kai is involved in science festivals such as “Explore Science” and develops interactives, which he presents together with his team to children and adults alike. He has also regularly given data science talks at “Netzwerk Recherche,” a large conference of German journalists. Apart from his research work, Kai Polsterer conceived of the exhibition for the new planetarium and visitor center “ESO Supernova” in Garching near Munich. Together with two developers, he created more than a dozen interactives and acted as scientific advisor to the planning of the center. Along with his group, Kai has plans to work on a new project: a combination of a construction plan and digital tools to collect, process, and visualize astronomical data. Kai remains convinced of one thing: “We will revolutionize data access.”

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Photos: HITS, Stefanie Bertsch, Gülay Keskin, Bernhard Kreutzer | www.h-its.org

### PORTRAIT

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Heidelberger Institut für  
Theoretische Studien



# THE CHARTS