

A special honor for a splendid scientist

In July, HITS awarded the highest distinction of the institute to mathematician and former group leader **Anna Wienhard**, now Director at the Max Planck Institute for Mathematics in the Sciences in Leipzig. The ceremony at the Studio Villa Bosch in Heidelberg was embedded in a "Math Colloquium" with two scientific talks to honor her achievements at the institute where she had been active for seven years.

Steve Trettel, University of San Francisco, California/USA, gave a talk on "Geometry from the Inside." He presented a menagerie of curved and twisted worlds. These new geometries have greatly expanded our mathematical universe and found applications from describing the curvature of space-time to representing data in machine learning. Richard Schwartz, Brown University, Rhode Island/USA, spoke about "5 Point Energy Minimization". He presented a proof



that used computer algebra, interval arithmetic, and symmetrization, with a computer demo showing the proof in action. Both talks can be viewed on the HITS YouTube channel (Steve Trettel: <https://youtu.be/o-1f2vJy52k>; Richard Schwartz: <https://youtu.be/JKUyZgjitEo>).

After the talks, HITS Scientific Director **Tilmann Gneiting** presented Anna Wienhard with the award of a HITS Fellow. In her acceptance words, she emphasized the

interdisciplinary atmosphere at the Institute. "Over the years, it has had a huge impact on my further development", she said. "HITS is a special place, and it has been very special for me." Apart from her affiliation with Leipzig, Anna Wienhard is still scientific chair of the Heidelberg Laureate Forum that will take place from 24-29 September this year.

The "HITS Fellow" distinction is given to scientists in recognition of outstanding contributions to defining and implementing the scientific agenda of HITS and exceptional service to the institute.

Anna Wienhard is the third HITS scientist to receive the award. Before her, only bioinformatician **Isabel Rojas** (1968-2013) and the astrophysicist **Volker Springel**, since 2018 Director at the Max Planck Institute for Astrophysics in Garching, were appointed HITS Fellows.



Via Data

The HITS blog can be found on the "Scilogs" portal at <https://scilogs.spektrum.de/via-data/>.

HITS

HITS Alumni Meeting "reloaded"

On 8 July 2023, HITSters and HITS alumni met at Studio Villa Bosch and the HITS



Campus, celebrating the first onsite meeting after a four years' break. Around 70 people attended the event, which was intertwined with a "Math Colloquium" in honor of former group leader Anna Wienhard (see "HITS").

The emphasis of the meeting was on exchange and networking between alumni and current HITSters. In a career panel session, three alumni shared

their experiences of the different career paths they have taken: **Ariane Nunes Alves** (formerly MCM, now TU Berlin, Germany), **Johannes Wagner** (formerly MBM, now Eraneos Analytics, Hamburg, Germany) and **Antonio Disanto** (formerly AIN, now aioneers, Mannheim, Germany).

In a "sit and sizzle" barbecue on the HITS campus afterwards, everybody enjoyed the beautiful and sunny summer afternoon until nightfall.

New employees and visiting scientists

Postdoc:	Jie Yu (TOS)
PhD students:	Mila Coetzee (MLI)
Master students:	Sophia Ber (MCM) Romain Chazotte (MLI), Boris Schüpp (MBM), Noah Wahl (CME)
Administration:	Jason Vay-Disterhöft (HR Team Assistant)
Communications:	Marisa de Sá Almeida (Junior Communications Manager)
Visiting scientists:	Mariia Demianenko (AIN, MPI Astronomy Heidelberg), Mike Lau (PSO, Croucher Fellowship), David Hermann Lehmann (DMQ, Heidelberg University)

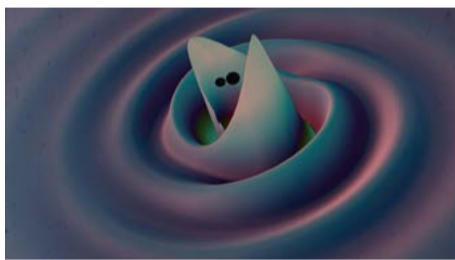
HITS groups (09/2023): Astroinformatics (AIN), Computational Carbon Chemistry (CCC), Computational Molecular Evolution (CME), Computational Statistics (CST), Data Mining and Uncertainty Quantification (DMQ), Groups and Geometry (GRG), Machine Learning and Artificial Intelligence (MLI), Molecular Biomechanics (MBM), Molecular and Cellular Modeling (MCM), Natural Language Processing (NLP), Physics of Stellar Objects (PSO), Scientific Databases and Visualization (SDBV), Stellar Evolution Theory (SET), Theory and Observations of Stars (TOS).

HITSters

The universal sound of black holes

They are mysterious, exciting and inescapable – black holes are some of the most exotic objects in the Universe. With gravitational-wave detectors, it is possible to detect the chirp sound that two black holes produce when they merge, approximately 70 such chirps have been found so far. HITS researchers from the Stellar Evolution Theory group (SET) now predict that in this "ocean of voices" chirps preferentially occur in two universal frequency ranges. The study has been published in *The Astrophysical Journal Letters*.

When two stellar-mass black holes merge, they emit gravitational waves of increasing frequency, the so-called chirp signal, that can be "heard" on Earth. From observing this frequency evolution (the chirp), scien-



tists can infer the so-called "chirp mass", a mathematical combination of the two individual black hole masses.

So far, it has been assumed that the merging black holes can have any mass. The team's models, however, suggest that some black holes come in standard masses that then result in universal chirps. "The existence of universal chirp masses not only tells us how black holes form", says SET group leader **Fabian Schneider**, who led the study, "it can also be used to infer which stars explode in supernovae."

Stellar-mass black holes with masses of approximately 3-100 times our Sun are the endpoints of massive stars that do not explode in supernovae but collapse into black holes. The progenitors of black holes that lead to mergers are originally born in binary star systems and experience several episodes of mass exchange between the components: in particular, both black holes are from stars that have been stripped off their envelopes. "The envelope stripping has severe consequences for the final fates of stars. For example, it leads to universal black hole masses as now predicted by our simulations", says co-author **Philipp Podsiadlowski**, currently Klaus Tschira Guest Professor at HITS. There seems to be a gap in the distribution of the chirp masses of

merging binary black holes, and evidence emerges for the existence of peaks at roughly 8 and 14 solar masses. These features correspond to the universal chirps predicted by the HITS team. "They can tell us a great deal about how these objects have formed", says **Eva Laplace**, the study's third author. The HITS team showed that – regardless of the chemical composition – stars that become envelope-stripped in close binaries form black holes of <9 and >16 solar masses but almost none in between. In merging black holes, the universal black-hole masses of approximately 9 and 16 solar masses logically imply universal chirp masses, i.e. universal sounds. "Because the number of observed black-hole mergers is still rather low, it is not clear yet whether this signal in the data is just a statistical fluke or not", says Fabian Schneider. Whatever the outcome of future gravitational-wave observations: the results will be exciting and help scientists understand better where the singing black holes in this ocean of voices come from.

Fabian R. N. Schneider, Philipp Podsiadlowski, and Eva Laplace: Bimodal Black Hole Mass Distribution and Chirp Masses of Binary Black Hole Mergers. 2023 ApJL 950 L9 DOI 10.3847/2041-8213/aced77a <https://iopscience.iop.org/article/10.3847/2041-8213/aced77a>

Research

Beyond the limits – Olexandr Isayev, Klaus Tschira Guest Professor



Sitting on the terrace and glancing at the young researchers at the adjacent table who are in the middle of a scientific debate, **Olexandr Isayev** smiles: "People here at HITS are the same kind as me – I grew up as the nerdy kid who disassembled things to find out how they work." The Ukrainian-born U.S. citizen, a chemist and associate professor at Carnegie Mellon University, enjoys the summery atmosphere. "I started

my tenure only three years ago, so this is my first sabbatical, and I am super delighted to be here for two months." This is, however, not his first visit to HITS: A specialist for machine learning in chemistry, Isayev was an invited speaker at the EuroQSAR meeting in Heidelberg 2022 hosted by **Rebecca Wade**. During that time he also came up to HITS to give a seminar talk. He returned to the institute at the beginning of May, as one of two Klaus Tschira Guest Professors in 2023. Since 2022, the Klaus Tschira Guest Professorship Program aims to enhance international exchange and scientific collaboration at HITS. Internationally renowned scientists are invited for sabbaticals or extended research stays. They collaborate with scientists at HITS, develop joint research projects, and engage with the wider scientific community at the institute and in the Heidelberg region.

"I have used the time to break the standard routines of my daily scientific work and think about the next steps", Olexandr Isayev says. "The chemistry labs today are still like they were 100 years ago, but the lab of the future will contain more algorithms and

digitization." With the groups of **Ganna "Any" Grynova** (CCC) and **Frauke Gräter** (MBM), he has explored new collaborations. "My lab has the machine learning methods, they have the applications", he states. "So we look at the reactions of radicals in collagen, and check the library of chemical compounds they have developed to find compounds with better properties." Moreover, Isayev participated as an invited speaker in the SIMPLAIX workshop in early May, held a HITS colloquium talk in June and a lecture at Heidelberg University. He also took his time to discuss AI and ethics with current HITS Journalist in Residence **Anil Ananthaswamy**. And he has also enjoyed the environment. "This area is the best part of the country: the mountains, the Rhine valley, the wine, local cuisine and little markets", he says. "This is hard to get in the U.S." Resuming his stay, Olexandr Isayev says: "You deliver the vision of your founder Klaus Tschira, making it a reality." And, with another glance at the young researchers next to him, he adds: "It's been an amazing time for me as a scientist, and it's a great culture here, like a big family. I almost feel like being a part of this family."

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Beyond the limits



The Charts