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PRO LOEWE NEWS

The LOEWE research initiatives report

TOPICS, NEWS AND INFORMATION FROM THE LOEWE RESEARCH NETWORK IN THIS PRO LOEWE-NEWS, AVAILABLE AT PROLOEWE.DE, LINKEDIN AND BLUESKY.

Cover photo: In addition to lectures and interactive workshops, the LOEWE-ADMIT Summer School offered researchers the opportunity to participate in hands-on sessions, such as this one by Prof. Boris Keil on measurement technology. The method allows participants to acquire new knowledge while performing a task or solving a problem. This not only makes the learning process more engaging but also contributes to better processing of new content and increases motivation and productivity. Photo: THM / Leonie Dittrich

RESILIENT SENSOR TECHNOLOGY AND CRISIS COMMUNICATION IN ONE BOX – LOEWE-EMERGENCITY MAKES THE LICHTENBERGBLOCK IN DARMSTADT MORE CRISIS-PROOF WITH "HEINERBOXES"

After years of research, several prototypes, and weeks of assembly, 40 sensor boxes from the **LOEWE Center emergenCITY** will be hanging on street lamps in the Lichtenbergblock – a ten-hectare section of Darmstadt's Martinsviertel – as of November this year. At a height of approximately four meters, they measure the neighborhood's microclimate and traffic.

What's special about them: The so-called Heinerboxes implement sensor technology in a resilient design that also considers communication channels for a potential crisis, existing infrastructure, and data protection from the outset. Thus, the boxes combine research with sustainable urban development and modern crisis communication – implemented entirely locally and openly accessible to everyone.

With the Heinerboxes, **LOEWE-emergenCITY** is supporting the measures for traffic calming and increased road safety implemented by Darmstadt, the "City of Science" in the Lichtenbergblock under the project title "Heinerblock". "The city benefits from the scientific analysis and monitoring of its measures without incurring additional costs," emphasizes Professor Matthias Hollick, scientific coordinator of the LOEWE Center.

The Heinerboxes measure temperature, air pressure, and humidity, as well as particulate matter and light levels in their immediate surroundings with high measurement density. Noise levels are also measured, and background noise is classified, for example as traffic noise, dog barking, or music. The boxes also record how public spaces are used: The LiDAR sensor uses a laser to detect when something crosses the path.

Citizens can see for themselves that the boxes do not collect any personal data: Each Heinerbox, or the lamppost to which it is attached, is equipped with a QR code, through which all recorded measurements can be viewed publicly online.

The sensor boxes and their communication network are built in such a way that both can be used in crisis situations – without electricity, internet or mobile network. The researchers are using existing streetlights for this purpose. At night, the lights supply the Heinerboxes with electricity. During the day, they operate on a battery. Furthermore, their communication network combines the energy-saving and long-range LoRa wireless technology, typical of urban sensor networks, with Wi-Fi and Bluetooth connections.

"We want to demonstrate how existing infrastructure and smart technology can increase a city's resilience," says Matthias Hollick.

This flexibility makes the sensor boxes and their communication network particularly resilient: Even if the power or mobile network fails for several days, the sensors can measure and transmit data via their network.

And especially in crisis situations, such data provides important information for emergency responders: Elevated particulate matter levels are often an indicator for a possible fire, and data on traffic volumes can provide important details for planning information and relief efforts.

The built-in wireless technologies are even suitable for setting up an emergency network in an emergency, through which, for example, warnings and instructions from the fire department could be spread or emergency calls could be made. The idea: connect to a box via Wi-Fi and have a simple website with situational information displayed on your phone. The **LOEWE Center emergenCITY** is now continuing to research these ideas with the Heinerboxes in the Lichtenbergblock as a real-world laboratory to make our cities more resilient in the event of a crisis.

Further information can be found at:
https://www.emergencity.de/missions/heinerblock/

And probably from the beginning of November also at:
www.heinerbox.tu-darmstadt.de

LOEWE emergenCITY spokesperson Matthias Hollick (left) and Heinerbox developer Frank Hessel (right) during the construction of the boxes. Photo: Gerd Keim

Starting in November, the Heinerboxes will hang on 40 street lamps in Darmstadt's Lichtenbergblock. Photo: Gerd Keim

Summer School participants in small groups during one of the hands-on sessions. Photo: THM/Leonie Dittrich

INTERDISCIPLINARY EXCHANGE AND NETWORKING: LOEWE-ADMIT'S FIRST INTERNATIONAL SUMMER SCHOOL FOR YOUNG RESEARCHERS IN MEDICAL PHYSICS

The **LOEWE Research Cluster ADMIT – Advanced Medical Physics in Imaging and Therapy** hosted the first Interdisciplinary Summer School of Medical Physics from August 19 to 22, 2025, at Rauischholzhausen Castle in Ebsdorfergrund, Central Hesse. Around 30 national and international participants gathered for this event. The goal was to provide young researchers with comprehensive insights into the fields of medical physics, as well as opportunities for networking and further training outside of their disciplines. The combination of the interdisciplinary expertise of the researchers involved in ADMIT proved to be very beneficial. All working groups and subproject leaders of ADMIT contributed to this, offering a broad range of perspectives.

The joint project **LOEWE-ADMIT**, consisting of the Technical University of Mittelhessen (THM), the Justus Liebig University of Giessen (JLU), and the Philipps University of Marburg (UMR) together with clinical and industrial partners, aims to combine new imaging and computer-assisted techniques with advanced therapeutic strategies to enable early diagnosis and successful treatment of various forms of cancer and neurodegenerative diseases.

The topics covered at the summer school ranged from radiation therapy and protection, detector physics, molecular radiobiology and dosimetry to imaging techniques such as computed tomography and magnetic resonance imaging and the use of AI. A significant focus was also placed on medical applications and the translation of research into clinical practice, with particular emphasis on neurology, diagnostic and interventional radiology, radiation oncology, and radiotherapy.

Among the highlights of the event was the keynote lecture by Prof. Oliver Jäkel from the German Cancer Research Center in Heidelberg on "Image Guided Therapy: Why and How?", which provided insights into the latest developments in image-guided therapy.

In addition to the basic introduction to the respective disciplines, there was also the opportunity to discuss current challenges, interdisciplinary interfaces and future perspectives. The specialist lectures were complemented by a number of other perspectives: For example, Dr. Oliver Schrenk offered insights into the work of the Freiburg-based medical technology company PTW, explaining the path from an idea to a product as well as aspects of innovation management. Participants were able to get involved in two hands-on sessions: Under the guidance of Prof. Kilian Baumann (subproject leader, THM), they were able to try their hand at radiation planning. Prof. Boris Keil (scientific coordinator of the **LOEWE Research Cluster ADMIT**, THM) offered the opportunity to participate in the manufacturing of measurement technology and try their hand at soldering, among other things.

Scientific communication was also taught in a practical way: The workshop on "Communicating Knowledge Effectively" led by the team from PhDSciCom offered inspiring ideas on how to communicate scientific findings clearly and effectively, particularly when using LinkedIn.

In addition to the professional input, another goal was clearly in focus: the opportunity to make new contacts and expand one's own network. The open atmosphere and welcoming culture of the speakers and participants in particular made the event a thoroughly successful experience, which has already given rise to initiatives and suggestions for the next **ADMIT Summer School in 2026**. The event was made possible, among other things, by a donation from the Hertie Foundation, for which we would like to express our sincere gratitude.

Had a great time at Rauischholzhausen Castle: The participants of the LOEWE-ADMIT Summer School. Photo: THM/Leonie Dittrich

Host and speaker, Prof. John Ziebuhr, spokesperson for LOEWE-Coropan, Prof. Volker Thiel, Prof. Sandra Ciesek, and Prof. Christian Drosten at the microphone. (from left to right)
Fotos: Dr. Christin Müller-Ruttloff, Lisa-Marie Seeber

LOEWE-COROPAN SYMPOSIUM ON CORONAVIRUS WITH CHRISTIAN DROSTEN AND OTHER LEADING SCIENTISTS FROM SEPTEMBER 23 TO 24 IN GIESSEN

Leading international experts in coronavirus research gathered at Justus Liebig University from September 23 to 24, 2025, at the invitation of the **LOEWE Research Cluster CoroPan**. One of the many highlights of the symposium was the lecture by Prof. Christian Drosten, Director of the Institute of Virology at the Charité in Berlin. Drosten became known to the general public through the NDR podcast "Coronavirus Update", which he recently co-hosted with Sandra Ciesek. He is one of the most frequently mentioned scientists in Germany in reporting on the pandemic.

After Prof. John Ziebuhr, Director of the Institute of Medical Virology at JLU Giessen and spokesperson for the **LOEWE Research Cluster CoroPan**, welcomed the participants and guests of the symposium, the event's scientific program began on September 23 with six sessions on various topics. One of the sessions was chaired by Prof. Sandra Ciesek, LOEWE Professor and co-spokesperson for **LOEWE-CoroPan**. She led the discussion on a lecture given by Prof. Volker Thiel (Bern, Switzerland) on new possibilities for producing highly effective and safe live vaccines against coronaviruses. Prof. Susanne Herold, also a LOEWE top researcher, led the discussion on the lecture by Prof. Julian Hiscox (Liverpool, UK) on genetic changes in coronaviruses as a result of different antiviral therapeutic approaches and possibilities for predicting such changes.

Further plenary lectures were given by leading international scientists in the field of coronavirus and related disciplines, including Prof. Marjolein Kikkert (Leiden, Netherlands), Dr. Kai Dallmeier (Leuven, Belgium), Prof. Manja Marz (Jena), and Prof. Isabella Eckerle (Geneva, Switzerland).

The session on "Emerging Viruses – Where Public Health, Diagnostics, and Translational Research Intersect" on the second day of the event was chaired by Prof. Stephan Becker, spokesperson for the LOEWE Center DRUID, which expired in 2024.

In addition, the various project leaders presented current findings from their **LOEWE-CoroPan-funded research projects** on various aspects of molecular biology and pathogenesis of coronaviruses, and the CoroPan junior scientists discussed their recent research data with the symposium participants in poster sessions.

In the closing lecture of the symposium Prof. Christian Drosten provided insights into the "ongoing evolution of MERS-CoV, a new coronavirus with pandemic potential that emerged several years ago".

"Overall, it was a very successful event, bringing together scientists of all career levels for two days of stimulating and inspiring exchange with international coronavirus experts. The presentations and discussions demonstrated that we are on the right track with our research and our numerous collaborations at the national and international levels. Without a doubt, this research will also make an important contribution to further improving our therapeutic and prophylactic strategies against various coronavirus infections, allowing us to look to the future with optimism," concluded Prof. John Ziebuhr.

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ProLOEWE. LOEWE Research Initiatives Network
Phone: +49 6421.2824482
kontakt-proloewe@uni-kassel.de
www.proloewe.de

Postal address:
ProLOEWE
c/o SYNMIKRO
Zentrum für Synthetische Mikrobiologie
Karl-von-Frisch-Straße 14
35043 Marburg
Germany

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Prof. Dr. Kristian Kersting and Prof. Constantin A. Rothkopf, Ph.D.
Two scientists in the "Tiefenrausch*"

Professor Kersting, Professor Rothkopf, the current issue of ProLOEWE faces will be the first double portrait. The reason for this will become clear to our readers as soon as they learn more about the origins of LOEWE-WhiteBox, for which you both serve as spokespersons. What is the goal you want to achieve with LOEWE-WhiteBox, and what makes your collaboration on this topic so special and inseparable? *[Constantin A. Rothkopf] With LOEWE-WhiteBox, we want to ensure that artificial intelligence no longer remains an impenetrable "black box", but is designed in such a way that we can understand and trust its decisions. In many areas, it's not enough for a system to simply deliver correct results; we also need to be able to understand how these results are generated. Imagine, for example, a medical diagnostic system that recommends a treatment. For doctors and patients, it's not enough to know that "the computer says: this is how it is." They want to understand the factors that led to this recommendation. This is precisely where WhiteBox comes in.*

What's special about our project is the close collaboration between two disciplines that are rarely combined so consistently: artificial intelligence (AI) and cognitive science. AI brings high-performance methods that can process millions of data in a short time, but are difficult to understand. Cognitive science, on the other hand, has been asking for decades: How do we actually explain intelligent behavior in humans? We humans, too, are a kind of black box – no one understands the brain in all its details. But we have found ways to make behavior understandable at a higher level, for example, by quantitatively describing goals, strategies, or rules and explaining them computationally.

For example, when a child learns to avoid obstacles while riding a bicycle, we can't explain it by the wiring of its billions of neurons. But we can say: "The child looks ahead, recognizes the obstacle, and decides to steer left." This kind of explanation is plausible. Of course, in cognitive science, we don't only have verbal descriptions; we can also formulate such explanations mathematically and algorithmically. The goal of WhiteBox is to transfer cognitive explanations to AI so that machines can also be explained in the way we humans expect it of each other.

It is precisely this connection, the power of modern AI and the explanatory power of cognitive science, that makes our project unique. Only when both disciplines

** Translated roughly as raptures of the deep*

Constantin Rothkopf (left) and Kristian Kersting (right), both professors at TU Darmstadt, have been working together since their first meeting in Osnabrück, where they discussed research ideas in the bar-café "Tiefenrausch" (translated roughly as raptures of the deep) after a long day at the university. It was there that the first ideas for a joint (LOEWE) project emerged. Photo: Fabian Wolf

work together can we develop AI that is not only powerful, but also transparent, trustworthy, and "human-centered" in the best sense of the word.

Many people may have a somewhat idealized vision of what it means to be a professor. Can you tell us something about this based on your own career path? *[Kristian Kersting] Many people imagine the daily life of a professor as one where they can calmly reflect on big ideas, perhaps discuss them with students, and thus advance science. In reality, the path to this, and even the daily routine itself, is much more complex – and often challenging.*

My own career path demonstrates this: There is no direct, straightforward path to a professorship. You go through various stages at home and abroad, have to assert yourself against international competition and invest a great deal of time in proposals and reviews. This contradiction is particularly evident in work on artificial intelligence: Research is developing exponentially fast, but our funding system is linear and slow. While we should actually be implementing new ideas quickly, we lose a lot of time in lengthy processes. The image that professors and professors primarily spend time thinking is therefore unfortunately not true.

Added to this are challenges within the science system itself: research funding is scarce, and when new resources flow into a groundbreaking field like AI, it often means that other areas receive less. This leads to battles over distribution and sometimes even envy – things that are rarely seen in public, but are unfortunately part of the story. At the same time, the world isn't waiting for German professors – it's waiting for solutions. If we hesitate, other countries may soon set the course.

This makes successes like LOEWE-WhiteBox and the two Clusters of Excellence "The Adaptive Mind" and "Reasonable AI", which were created in part thanks to WhiteBox, all the more important. They are not only scientific beacons, but also proof that we can create internationally visible structures that promote research and young talent alike. For me personally, these projects are a true success story: We only began collaborating in these fields at TU Darmstadt nine years ago. They give us hope that, especially in these two Clusters of Excellence, we as scientists can once again take time to think – time that we urgently need to help shape the next major step in AI development from Hesse.

After describing the challenges of academic life, what is special about the LOEWE program? *[Kristian Kersting] The LOEWE program is something special in Germany because it can create freedom. Many large national or European programs are more drawn out and lack regional relevance, so innovative ideas can get lost in the mass of applications. LOEWE, on the other hand, deliberately focuses on Hessian funding: fast, direct, close to researchers, and with a clear focus on its own state. Almost like a savings bank. When applying for a loan from a large international bank, the process is often very lengthy, bureaucratic, and impersonal. A local savings bank is much more targeted because it knows the region and understands exactly where the strengths and needs lie. For us at WhiteBox, this freedom was crucial. We were able to build a bridge between artificial intelligence and cognitive science, something we believed in from the start, but which might have been considered too risky or too unusual in traditional programs. LOEWE enabled us to be bold and work across disciplines.*

This is also a major advantage for Hesse: LOEWE specifically promotes the region's strengths and raises their international profile. WhiteBox, as well as the resulting Clusters of Excellence "The Adaptive Mind" and "Reasonable AI," clearly demonstrate how regional funding can create true beacons that radiate far beyond Hesse.

In short: LOEWE gives us the freedom to think scientifically and explore new approaches – and at the same time, it contributes to Hesse's profile as a location for cutting-edge research sustainably.

Now the funding for your LOEWE project is running out at the end of this year, but with RAI and TAM, you have managed to secure and participate in two Clusters of Excellence. A truly extraordinary achievement! Please explain to us why this is so important, what it means to work toward excellence, and, of course, how much LOEWE is involved. *[Constantin A. Rothkopf] The fact that we were able to establish two Clusters of Excellence from WhiteBox, "The Adaptive Mind" and "Reasonable AI", is indeed an extraordinary success, not only for us researchers, but for the state of Hesse as a whole. Excellence doesn't mean promising a revolution every year. Excellence means setting the pace internationally and not just reacting. It means the highest scientific quality, critically questioning trends, and the freedom to develop new, unconventional ideas. These are precisely the conditions under which real breakthroughs can emerge.*

This is of great importance for a state like Hesse: Clusters of Excellence are not just scientific flagships, they also attract talent, companies, and investments. They create an environment where the best minds stay or come to us because they know they can conduct world-class research here. This creates an innovation ecosystem that extends far beyond the universities into the economy and society. Support for startups cannot be considered in isolation; the ecosystem must be taken into account as well.

And, of course, LOEWE has a lot to do with this success. Without targeted, regional funding, we probably wouldn't have been able to realize the risky idea of systematically merging AI and cognitive science. LOEWE gave us the freedom to dare to try new things. This freedom has given rise to structures that are now internationally visible. We can say: LOEWE was and remains a key building block for the Clusters of Excellence and is a part of the foundation upon which Hesse today plays an internationally visible role in artificial intelligence and cognitive science. This makes it all the more important that Hesse continues to support science!

The interview was conducted by Tanja Desch.
The full interview can be found at
https://proloewe.de/en.