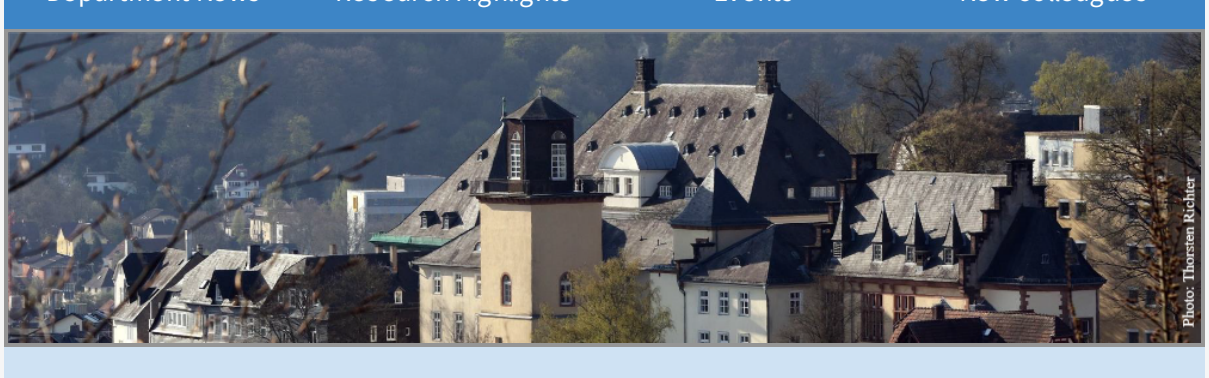
Philipps Universität Marburg

Newsletter Physics 07/22

Department News | Research Highlights | Events | New colleagues



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News from the Department

Department summer party

The Fachschaft invites all members of the department to a summer party on Wednesday, 13th July 2022 starting at 3 pm. The party will be at the parking slot behind the Renthof 7 and there will be a barbeque (including vegan food), drinks and music.
Our new professors, Marina Gerhart, Jan-Christoph Goldschmidt, Jens Güdde and Ermin Malic, would like to use the oppportunity to raise a glass with you.

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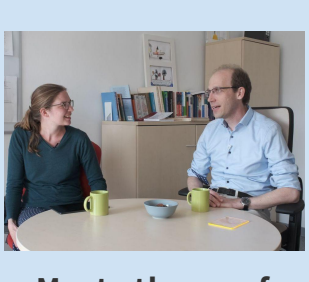

Meet - the - prof Video interview with Jan Christoph Goldschmidt

The PR group starts a new series of video interviews "meet-the-prof" with professors from our department. The idea is to offer new (and older) students the opportunities to get to know the professors from a different perspective.
We start the series with Jan Christoph Goldschmidt, who recently started his Solar Energy Conversion Group at our department. More video interview will follow in the next months. The interview was done by Josefine Neuhaus and the video was cut by Nico Hofeditz.

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Tischlein Deck Dich

The event “Tischlein Deck Dich” was a complete success. The table of the physics department was very well attended, our giveaways were diligently distributed and we especially thank Prof. Dr. Jänsch who entertained us with his exciting experiments the whole day. He was actively supported in the preparations and the event by Josefine Neuhaus, Eike Pohlenz, Stefan Brackmann and Julia Prume. Special thanks also go to Catrin Ellenberger and her co-workers, Florian Fuchs and Lukas Kotuscha, from the AG Didaktik, who spontaneously and quite unplanned helped to pack the giveaways with an unipolar motor, a pen and flyers.

SFB 1083 Summer school 2022 26. - 28. September

Two-dimensional (2D) materials such as transition metal dichalcogenides (TMDCs) are receiving large interest because of their fascinating physical properties that result from the confinement of electronic states in such layers. Moreover, stacking different 2D materials or combining them with organic semiconductor films enables the fabrication of heterostacks with atomically sharp interfaces that show great potential for future electronic or optoelectronic device applications. The summer school is organized by the collaborated research center (SFB 1083) and will take place in rural surroundings on the edge of the Westerwald not far from Bonn and Cologne. Aimed at PhD students, it offers overview and introductory lectures on various topics ranging from fundamental chemical, physical and optoelectronic properties of TMDCs and heterostructures to experimental techniques to study their properties as well as their integration into future devices. Student participants are also encouraged to present a poster of their own work, which should also be promoted in form of a 5-minute short presentation.

read more

registration

Information event at the Schwalm-Gymnasium

Inspire pupils to study physics is one of the tasks that the PR team has set itself. In June, Josefine Neuhaus visited the Schwalmgymnasium in Treysa. In the context of the 'Firmeninformationstag' she gave a presentation to pupils of the 11th and 12th grade, informed on different possibilities to study physics at our deparment and showed the broad research spectrum of topics covered in our department. Even students who had already dropped out of physics were enthusiastic about the diversity and the different research fields. The small experiment Josefine brought with her also triggered the students' urge to play and discover and became a topic of conversation beyond the event itself.

read more

Department logo

The PR team has designed a new logo for the physics department based on the original idea from the Fachschaft. Feel free to use it. We have also pens and pencils with (an adjusted) logo of the department. If you would like to have one, you can pick it up at the office of Carina Hlawaty (AG Ultrafast Quantum Dynamics). We will also distribute some at the department summer party.

Research Highlights

Revealing fundamentals of charge extraction in photovoltaic devices **(AG Goldschmidt)**

Photoluminescence (PL) is a fundamental property of semiconductor devices such as solar cells. When a sample is illuminated, free charge carriers are generated that can recombine radiatively by emitting light of a characteristic wavelength. Researchers from the Solar Energy Conversion group (AG Goldschmidt) together with colleagues from Fraunhofer ISE, University Freiburg, ERCMN Morocco and EPFL Switzerland used this principle to create images of the charge extraction efficiency of solar cells. Thereby, they made use of the observation that optically excited charge carriers tend to recombine radiatively when the solar cell is in open circuit. However, if the sample is biased to short circuit, the charge carriers are extracted and do not contribute the photoluminescence. This approach is especially attractive to characterize the perovskite solar cells, whose thin film layers are known to show large heterogeneities. By recording PL images at different electrical bias, the researchers were able to identify regions of high and low charge extraction and link it to charge carrier dynamics at the interfaces. The work was published in the journal Matter.

read more

Performance of perovskite-on-silicon tandem solar cells **(AG Goldschmidt)**

Perovskite silicon tandem solar cells promise to increase efficiency and reduce electricity costs in comparison to standard silicon solar cells. Such tandem solar cells are manufactured by depositing additional contact layers and the perovskite absorber directly on the silicon solar cell. Like any other production step, this is associated with additional environmental costs, such as resource usage, potential pollution etc. Researches from the Solar Energy Conversion Group (AG Goldschmidt) together with colleagues from the TU Berlin, Helmholtz Zentrum Berlin and the company Oxford PV have now investigated, whether the higher efficiency can overcompensate the additional environmental costs. They found that because of the additional production steps the environmental impact per photovoltaic module increased by up to 7%. However, as more electricity can be produced from such a module and accordingly the overall system, per kWh hour of electricity the environmental impact decreased by 6-18%. The work was published in the journal Sustainable Energy & Fuels.

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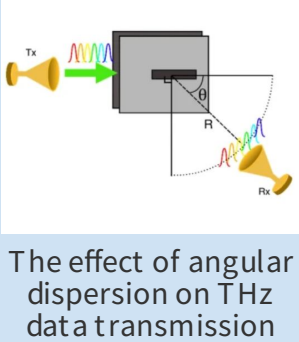

Radiative pattern of intralayer and interlayer excitons in 2D materials **(AG Koch)**

Mohammend Nouh from the Semiconductor Photonics Group was able to show that so-called charge-transfer excitons in heterobilayers of transition metal dichalcogenides exhibit a different emission behavior than direct excitons which are only located in one material layer. The reason for this is that the charge-transfer excitons do not have a pure dipol moment in the plane of the material but also have a component perpendicular to it. The work was carried out under the supervision of Dr. Arash Rahimi-Iman, who recently moved to the University of Giessen. It has just been published in Scientific Reports.

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Press release

The effect of angular dispersion on THz data transmission **(AG Koch)**

Currently standard wireless telecommunications such as WiFi and mobile networks operate in the band around 3GHz. As the world demands higher wireless data transfer speeds the need to move to higher carrier frequencies is one of the main drivers for terahertz technology development. A key distinctions between the current "low-frequency" wireless systems and future THz wireless transmissions is that THz links will require high directionality, to overcome the large free-space path loss. Because of this directionality, optical phenomena become increasingly important as design considerations. For instance the inherent frequency dependence of diffraction can lead to the angular separation of side-bands, which contain the information encoded in the modulation, this is a limitation that has never been a concern in "low-frequency" omnidirectional systems. In this work, Enrique Castro-Camus, guest professor at AG Koch, and collaborators explore the implications of this type of effect by incorporating either a diffraction grating or a leaky wave antenna into a communication link. These general considerations will have significant implications for the robustness of data transmissions at high frequencies. The work was published in Scientific reports.

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Interpreted machine learning in fluid dynamics **(AG Eckhardt)**

In this work we introduce the idea of interpretable machine learning to the fluid dynamics community. Often, interpretable and well performing machine learning models are mutually exclusive. In our work, we first predict relaminarisation events in plane Couette flow with gradient boosted trees and subsequently explain their predictions, using methods from game theory, as to connect this data-driven approach to our physical understanding of the process. The work was published in the Journal of Fluid Mechanics.

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Events

University Summer party, 1st July, 2 pm

You are cordially invited to join the celebration in the New Botanical Garden on the Lahnberge. Enjoy the live music program, which includes country singer Dana Marie, the band "Die Schwindler", the student big band and the Unichor Marburg. Enjoyment is also on the culinary agenda, for example at the show cooking with the head chef of the Student Union, Martin Baumgarten, or at the chocolate tasting with Annette Klingelhöfer.
And finally, enjoy the many hands-on activities and the information about the university and the Botanical Garden, for example in a themed tour of the "Greenhouses around the World" or about tropical orchids. Students, scientists and employees have designed the program with many interesting and unusual contents for you.

programme

Colloquium
Prof. Dr. Jochen Triesch
7. Jul, 5:15 pm

Prof. Dr. Jochen Triesch
(Frankfurt Institute of Advanced Studies, Frankfurt)

Learning to See without Supervision

Biological brains can learn much more autonomously than today’s AI systems and robots. How does this work and can we reproduce such autonomous learning abilities in artificial systems? Over the last years we have been studying this question for the case of visual perception. We have constructed models of how human infants learn to see the world in three dimensions, begin to track moving objects and learn to recognize them without any supervision. We have compared these models to biological data and validated them on physical robots. Studying the computational principles underlying these learning processes, we highlight effective information compression as the central driving force behind our brain’s ability to learn to see without supervision.

Colloquium
Prof. Dr. Andreas Knorr
14. Jul, 5:15 pm

Prof. Dr. Andreas Knorr
(Technische Universität Berlin, Berlin)

Excitation Transfer in Atomically Thin Materials

The decoration of atomically thin materials with nanostructures allows to study a variety of excitation phenomena at two dimensional interfaces. This includes different charge-, Dexter- or Förster-type transfer processes in heterostructures of atomically thin semiconductors functionalized with molecules, metal nanoparticles and graphene. In this talk, we discuss an approach to the theoretical description of different excitation transfer and strong coupling processes after optical excitation and the formation of hybrid excitations, their propagation and decay. Throughout the talk, a comparison with recent experiments (absorption, luminescence and angle resolved photoemission spectroscopy) will be provided.

WILHELM UND ELSE HERAEUS-STIFTUNG

Alfred-Wegener Dissertation Prize
21. Jul, 5:00 pm

On July 21st, the Alfred-Wegener Dissertation Prize, donated by the Wilhelm and Else Hereaus. Foundation, will be awarded to the prize-winners Dr. Lars Bannow (2019) and Dr. Felix Widdascheck (2021). The academic ceremony, to which everyone is cordially invited, takes place in the large lecture hall at Renthof 5 and begins at 5 pm. In addition to musical accompaniment by the guitar duo Duophonic, Prof. Dr. Alfred Nordmann from the Institute for Philosophy at the TU Darmstadt will give a lecture on the subject of "Naturwissenschaft als Beruf" followed by a reception on the outdoor area.

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MINT-SommerCamps Hessen

MINT Summer Camp
25. - 29. Jul, 9:00 am

MINT Summer Camp visits the Physics Department. The Marburg high schools are organizing a MINT summer camp from 25 to 29 July. One of the activities will be a visit at the Physics Department. The students will observe high energy particles in a cloud chamber, solar prominences using a H-Alpha telescope, and get an introduction into the history of astronomy. The MINT summer camps are meant to pave the way for a future student lab, excessible for interested young researchers to encourage their creativity.

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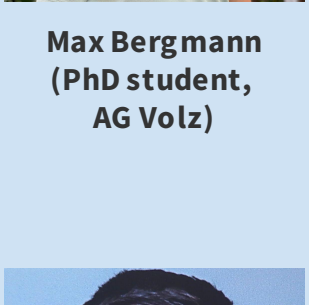

Night of the stars
6. Aug, 9:30 pm

Parade of planets and meteors: Join the starry sky tour on Saturday, 6th August at the Botanical Garden of the University. Start at 9.30 pm. In this night you have purely theoretically the possibility to admire all outer planets!

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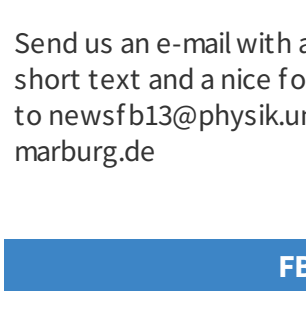
New Colleagues

Max Bergmann (PhD student, AG Volz)

I recently finished my master thesis in the group of Prof. Noack, where I studied a model of spinless fermions on a 2D-grid using DMRG. In June I started as a PhD student in the group of Prof. Volz. Here I want to calculate charge-densities between layers of 2D materials, especially graphene, using DFT. The charge-densities lead to electric fields, which can be seen under the STEM or in a STEM-simulation. My interests are programming and simulations. Besides physics, I enjoy playing the piano or trombone.



Alexander Schauerte (PhD student, AG Gerhard)

I recently finished my M.Sc. in physics at the Ruhr-University in Bochum, focussing on PL-spectroscopy in my master thesis. Now I am joining the group of Marina Gerhard as a PhD student to examine perovskites and organic-inorganic compounds using optical spectroscopy. I will investigate the relation between optical and structural properties at the nano- and microscale in these materials, with a particular focus on the dynamic disorder. In my free time I like to read, play video games, and do all kinds of sports, my favourites being football and beach volleyball.

Share your good news

Your newsletter team: Carina Hlawaty and Ermin Malic

Send us an e-mail with a short text and a nice foto to newsfb13@physik.uni-marburg.de

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