Case study 1: Some research highlights.

Synergy in Theory.

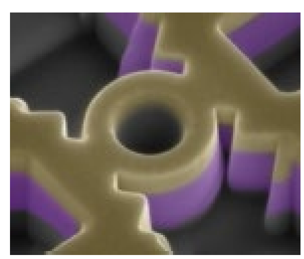
The Institute Lorentz (IL), an integral part of LION, is as vibrant in its 101st year as in the early days of Lorentz and Ehrenfest. Purposely, the IL is broad. The staff covers the physics from the dynamics and organization of cells to the formation of our universe, the intricacies of quantum many-body-physics, and to classical networks. Yet we are a whole, joined by the universal applicability of the concepts and building blocks of theoretical physics. This makes the Institute Lorentz a natural environment for cross-field collaboration.

A recent PRL by early universe particle astrophysicist Alexey Boyarsky together with quantum condensed matter physicist Vadim Cheianov exemplifies this [1]: chiral asymmetry plays a role in topological insulators as well as in the Standard Model of Particle Physics, which is also chiral - that is even crucial for the abundance of matter over antimatter in the early universe. Combining their insights, Alexey, Vadim and collaborators have shown that a correct treatment of chiral asymmetry can spectacularly modify the electrodynamics and hydrodynamics of a system, including our early Universe. Previous estimates of the influence of this asymmetry on the collective many body dynamics were two orders of magnitude off. Their new proposed improved modification can materially affect understanding of the electrodynamics of the early Universe.

The clearest example is the long collaboration between string theorist Koenraad Schalm and strongly correlated systems expert Jan Zaanen. Since 2009 they have pursued the idea that the string-theoretical description of virtual black holes in an imagined five-dimensional spacetime also describe the physics of strongly interacting quantum systems. Applying this mathematical relation, known as the holographic AdS/CFT correspondence, to a strongly correlated version of a doped Mott insulator, they recently found that such holographic Mott insulators differ from textbook Mott insulators [2]. The resulting charged density wave periodicity becomes detached from the doping charge, and there is a remnant DC resistivity. Remarkably, these are precisely also unexplained features seen in the cuprate high T_c superconductors which are doped Mott insulators [2].

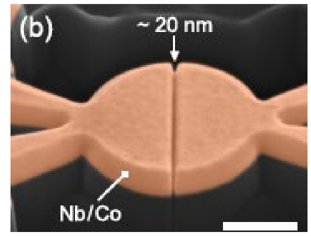
References:
[1] Evolution of the Primordial Axial Charge across Cosmic Times, A. Boyarsky, V. Cheianov, O. Ruchayskiy, and O. Sobol, Phys. Rev. Lett. 126, 021801 (2021).
[2] Doping the holographic Mott insulator, T. Andrade, A. Krikun, K. Schalm, J. Zaanen, Nature Physics (14), 1049 (2018).

Chiral superconductors and spin-polarized supercurrents



One of the research subjects in the section Quantum Matter and Optics of LION concerns superconductivity, and its interplay with (ferro)magnetism. A special approach taken in the research is to fabricate mesoscopic devices by way of Focused Ion Beam etching. One example is a micron-sized ring, made from single crystalline Sr_2RuO_4. Transport measurements of such a ring in its superconducting state show that two weak links form spontaneously in the arms of the ring, making it behave as a superconducting quantum interference device [1]. The cause of the weak links appears to be domain walls, which are a consequence of a chiral (two-component) order parameter. Even though Sr_2RuO_4 is not believed to be a p-wave spin-triplet system anymore, the ring structure provides a unique smoking gun for the chirality.

Another example is a micron-sized disk, made out of bilayer of the ferromagnet Co and the superconductor Nb. A ferromagnetic weak link can be fabricated by making a trench in the middle of the disk. A supercurrent can now flow through the Co, over a distance which is normally not allowed by the (exchange) pair breaking. In this case, however, equal-spin triplet Cooper pairs are formed by the interaction of conventional spin singlets from the Nb with the spin texture in the Co disk, where a magnetic vortex has formed [2]. The supercurrents are stronglysensitive to changes in the spin texture by small in-plane magnetic field, which is of possible use in superconducting memory elements.

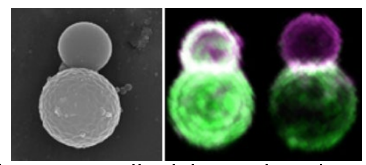


[1] Spontaneous emergence of Josephson junctions in homogeneous rings of single-crystal Sr_2RuO_4, Y. Yasui, K. Lahabi, V. F. Becerra, R. Fermin, M. S. Anwar, S. Yonezawa, T. Terashima, M. V. Milosevic, J. Aarts, and Y. Maeno, NPJ QUANTUM MATERIALS 5, 21 (2020).
[2] Superconducting Triplet Rim Currents in a Spin-Textured Ferromagnetic Disk, R. Fermin, D. van Dinter, M. Hubert, B. Woltjes, M. Silaev, J. Aarts, and K. Lahabi, *Nano Lett.* 22, 2209–2216 (2022).

From metamaterials to active matter and biology

In the Biological and Soft Matter section, our research covers a wide length scale from molecules in the cell to active and passive colloidal model systems at the micrometer scale and macroscopic mechanical metamaterials.

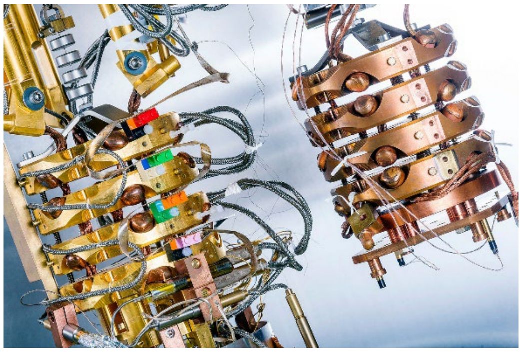
To illustrate research at the *microscopic* length scale, we chose our recent work on phase separation of lipid membranes. Previous work had found a correlation between membrane geometry and lipid domain composition, but_a precise understanding was elusive because they were coupled. The group of Daniela Kraft developed a new experimental model system of lipid-membrane coated (an)isotropic colloidal particles whose fixed geometry allowed disentangling the contributions from geometry and membrane composition. Careful and systematic characterization of the lipid composition found in experiments, and comparison with simulations and theoretical modelling done by Luca Giomi (Institute Lorentz) not only allowed us to identify when phase separation occurs, but to discover a new state, the *antimixed* state, where the lipids are mixed but their relative concentration varies across the membrane. We were able to show that the antimixed state only appears for fixed geometry and a closed surface.[1] The results provided critical insights into phase separation of cells and more generally two-dimensional fluids on curved substrates.



Recent research on the *macroscopic* length scale has focused on mechanical metamaterials, which are an excellent system for testing and understanding new concepts in the design and behavior of novel materials. The group of Martin van Hecke has been pushing the forefront of this field, from exploiting combinatorial design to create new materials to exploiting them in mechanical information processing. A crucial step for levering mechanical metamaterials for complex tasks was to create shape-changing, macroscale mechanical metamaterials that undergo self-guided, multi-step reconfiguration in response to global uniform compression [2]. The design of the metamaterials combined nonlinear mechanical elements with a multimodal architecture that enables a sequence of topological reconfigurations caused by the formation of internal self-contacts between the elements of the metamaterial. The insights from these studies allowed rational design of the pathways and discovered that errors can be suppressed, thereby pushing the boundary of complexity in design, and opening a new direction towards materials with controllable pathways and embedded information processing.

[1] Geometric pinning and antimixing in scaffolded lipid vesicles, M. Rinaldin, P. Fonda, L. Giomi, D. J. Kraft, *Nature Communications*, 11:4313 (2020).
[2] Multi-step self-guided pathways for shape-changing metamaterials
C. Coulais, A. Sabbadini, F. Vink and M van Hecke, *Nature,* 561, 512 (2018)

Case study 2: Applied Quantum Algorithms



It has been said that "using quantum principles to compute is as different from classical computing as a classical supercomputer is from an abacus", but from a computer science perspective the difference is more radical. TFor the classical computer, the way in which we calculate has not changed in any fundamental way; we still perform the same arithmetic operations on numbers, whether they are encoded on our fingers in base 10 or on bits in base 2. A quantum computer however provides a fundamentally new computational model, by operating on bits in quantum superposition (qubits).

We do not yet know whether this difference actually means that a quantum computer is more powerful than a classical computer on a meaningful task. To explore this is the research mission of the Applied Quantum Algorithms (aQa) initiative (www.aqa.universiteitleiden.nl/) , which started in 2016 as a joint effort of the Leiden Institutes of physics (LION) and computer science (LIACS), and also took on board the Leiden Mathematical Institute. The joint nature is reflected in the fact that two tenure track hires (Evert van Nieuwenburg and Vedran Dunjko) have a joint appointment at LION and LIACS; also, the students (both MSc students and PhD students) come from both communities. The algorithmic way of approaching a problem is new for many physicists, while the idea that there is more to qubit than a two-level system is new for many computer scientists.

The interdisciplinary approach is one way in which this initiative stands out, the involvement of industry is another. The focus of aQa on the development of use cases for near-term quantum computers makes it an attractive partner for a variety of industrial partners. The aQa initiative was launched by a major investment from Shell Research, to explore quantum computational chemistry applications, and this has expanded into applications in quantum machine learning and optimization (with support by Total and Volkswagen). Moreover, the aQa group receives significant support from the ‘Quantum Growth fund’, through a number of PhD and postdoc positions.

The managing and working of aQa also gives a good example of talent management at LION. Talent is a rare commodity, in particularly in a highly competitive field as quantum computing. When we see an opportunity to attract an exceptional talent we can act quickly. Our initiative in quantum algorithms was pioneered by a Ph.D. student, Tom O'Brien, who showed an unusual talent in this new field of research. By the time Tom defended his thesis he was running his own research group, and we offered him a position as assistant professor --- which he accepted. Eventually, Google made him an offer he could not refuse, but he retains a visiting position in Leiden and we benefit much from the Google connection. Several of our students have secondments at Google Research, where they can try out quantum algorithms on state-of-the-art hardware.

Case Study 3: The Story of Econophysics

It is a story that started in 2008, when LION joined forces with the company Duyfken Trading Knowledge for a new research and education program on Econophysics. The program studies the behavior of financial markets and economic systems by applying principles that are typically used in physics.

The financial crisis of 2007-2008, the recent global pandemic and the current war-driven international energy and food crisis have highlighted how the established approaches used by individual disciplines (such as finance, epidemiology, and economics) can fail systematically in specific regimes. This happens when the events under study (e.g. the bankruptcy of a firm or the infection of a community) are no longer isolated, but propagate from element to element across a very large system. This is not so different from molecules or other particles: the nature of the scientific challenge resides in the *interactions* among the constituents. This is the domain of statistical physics, which investigates how macroscopic properties and collective behaviour emerge out of the interaction among the elements. *Econophysics* tackles societal challenges with a physics approach: analyse data, characterize patterns, identify symmetries, propose theoretical models, test whether the model can replicate the empirical patterns, and possibly predict future behaviour or responses to perturbations. The holy grail of Econophysics is making improved recommendations to policymakers and governmental institutions.

Over the years, the *Econophysics and Network Theory* (ENT) group at LION, led by Dr. Diego Garlaschelli, has developed a distinctive approach focusing on the interplay between the stability of financial and economic systems and the structure of the underlying networks of interactions between banks and firms. The group has established long-lasting collaborations with societal partners. With DNB (the Dutch Central Bank), it analysed the network of exposures among all Dutch banks and identified specific structural changes that had occurred prior to the 2007-2008 crisis – thus interpretable as early-warning signals [1] (which, incidentally, could not be identified by any standard technique from the regulatory literature).

The group also introduced methods of network reconstruction from partial information, entirely based on generalized statistical-physics techniques [2]. Such methods are needed in order to statistically infer the unobservable structure of microscopic financial and economic networks that are typically protected by confidentiality. A large comparative study, performed by a consortium of central banks led by DNB, found that the methods proposed by the ENT group are the best performing probabilistic methods, setting the state of the art in the field [3].

A more recent collaboration with the two largest Dutch banks (ING and ABN-AMRO) resulted in the analysis of the network of transactions among Dutch firms [4]. In collaboration with the statistical office of the Netherlands (CBS), similar analyses are ongoing at the level of the industry-industry network, with additional information about the products being exchanged in the network. A collaboration with KPN, the main connectivity provider in the Netherlands, is taking shape at the moment on the topic of anomaly and fraud detection in communication networks.

Overall, the ENT group has established a unique interdisciplinary network with tight connections to key societal partners in the Netherlands (DNB, CBS, ING, ABN-AMRO, KPN) and acts as a bridge between purely theoretical research in the statistical physics of networks and societally relevant issues.

[1] http://dx.doi.org/10.1038/srep03357

[2] http://dx.doi.org/10.1016/j.physrep.2018.06.008

[3] https://doi.org/10.1016/j.jfs.2017.05.012

[4] https://doi.org/10.48550/arXiv.2111.15248

Case study 4: world-class scientific instrumentation

Many scientific discoveries are direct consequences of the development of novel instruments. Examples are the famous liquification of Helium in Leiden (Nobel prize 1908), and the recent discovery of gravitational waves (Nobel prize 2022). Furthermore, instrumentation developed for science has often led to significant technological progress, applicable in other areas.

Making instrumentation for ground-breaking physics is one of LION's core strengths. LION has a unique position for building and using novel instruments: we are in close proximity of the Leidse instrumentmakers School (started by physicist Kamerlingh Onnes with the very goal of high-class instrumentation), we host and support an excellent fine mechanical engineering workshop, and we have a set of experimental groups that combine technological know-how with a drive for better experiments. Many of our projects have not only led to scientific discoveries, but also to collaborations with industry and even to spin-out companies.

A first example is the Low Energy Electron Microscopy (LEEM) which currently holds the world record for spatial resolution. Research on and around this instrument has led to an ongoing collaboration with the company SPECS GmbH (Berlin), e.g via a running EU FET ProActive grant (ONEM). The Van der Molen group, running the LEEM for research on 2D materials, has introduced several new methods based on LEEM instrumentation. There was ARRES (angle-resolved reflected electron spectroscopy, probing the unoccupied band structure of a material [1]), and LEEM-based potentiometry. More recently, they pioneered low-energy transmission electron microscopy (eV-TEM), i.e. TEM working at remarkably low electron energies (0-20 eV, instead of the common 100-300 keV) [2]. The new EU project introduces ONEM (optical near-field electron microscopy), a novel microscopy technique for (bio)organic systems that combines the advantages of visible-light microscopy (no damage) and electron microscopy (excellent resolution). The group actively shares its knowledge and software via publications, personal communication and open-source platforms [3].

A second example is the milli-Kelvin scanning probe setup developed in the Oosterkamp group. It holds the world record in combining low mechanical vibrations and low temperatures, which is important for the scanning probe method of MRFM to perform nano-MRI [4] as well as for quantum experiments on mechanical objects. The mechanical motion at low temperatures is reduced by vibration isolation inside a cryogen-free cryostat and is used to put an upper limit on parameters in collapse theories [5]. Recent improvements have shown that these mechanical resonators can be cooled to 1 mK and that gravity can be measured at frequencies around 20 Hz. The instrumentation developments have led to three local start-ups.

A third example concerns the scanning tunneling microscopes developed in the Allan lab. Since its inception in 2015 at LION, the group has pushed the boundary of novel instruments. First, it managed to build the world's most stable scanning probe instrument [6]. A much larger project was the development of a novel shot-noise microscope. The microscope allows the measurement of superconductor pair formation directly and unambiguously, on the atomic scale. The most important discovery it has led to is a novel quantum liquid in disordered superconductors. It was discovered at LION that the metallic state just above the phase transition (still) consists entirely of electron pairs [7]. Since the development of this instrument, several other groups have (often with the help of the Allan lab) built their own version. The know-how is also licensed (non-exclusively) to the company UNISOKU. The licensing arrangement provides research groups looking for a turn-key solution to just buy the setup, and proves the value of the instrumentation for companies.

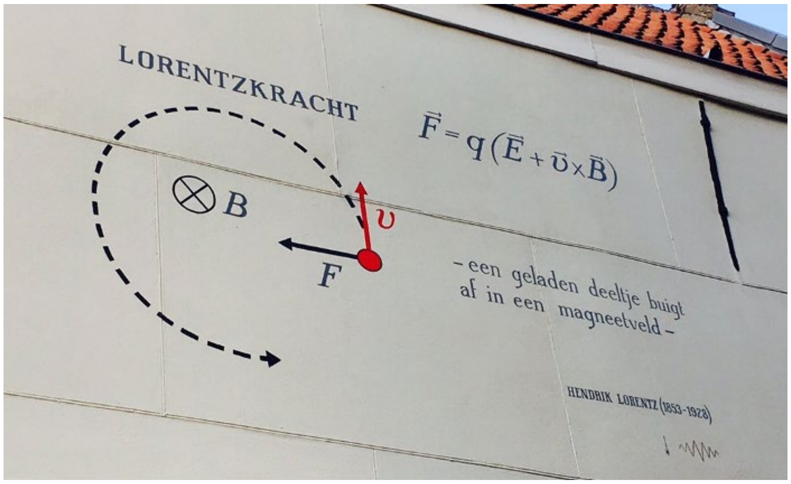
References:

1. J. Jobst and S. J. van der Molen, *A new perspective on new materials*, Europhysics News 49(4): 23-26 (2018).

2. D. Geelen, J. Jobst, E. E. Krasovskii, S. J. van der Molen and R. M. Tromp, *Nonuniversal transverse electron mean free path through few-layer graphene*, Phys. Rev. Lett. 123(8): 086802 (2019).
3. See for example: Github.com/TAdeJong
4. M. de Wit, G. Welker, J.J.T. Wagenaar, F.G. Hoekstra, T.H. Oosterkamp, *Feasibility of imaging using Boltzmann polarization in nuclear Magnetic Resonance Force Microscopy*, Journal of Applied Physics 125 (8): 083901 (2019).
5. A. Vinante, M. Bahrami, A. Bassi, O. Usenko, G.H.C.J. Wijts, T. H. Oosterkamp, *Upper Bounds on Spontaneous Wave-Function Collapse Models Using Millikelvin-Cooled Nanocantilevers*, Phys. Rev. Lett **116** 090402 (2016).
6. K. M. Bastiaans, T. Benschop, D. Chatzopoulos, D. Cho, Q. Dong, Y. Jin, M. P. Allan, *Amplifier for scanning tunneling microscopy at MHz frequencies*, Rev. Sci. Instrum. 89, 093709 (2018)
7. K. M. Bastiaans, D. Chatzopoulos, J.-F. Ge, D. Cho, W. O. Tromp, J.M. van Ruitenbeek, M.H. Fischer, P. J. de Visser, D. J. Thoen, E. F. C. Driessen, T. M. Klapwijk, M. P. Allan, *Direct evidence for Cooper pairing without a spectral gap in a disordered superconductor above* T_c , Science 374, 608 (2021)

Case Study 5: Wall formulas

Leiden has a rich academic tradition in science, not in the least in physics. To celebrate key discoveries made in Leiden, a rather unique form of science communication has been started: '**Wall formulas**' have appeared in the city of Leiden. Or more precisely, walls have been ornamented with an important formula from physics or astronomy with a strong Leiden connection. With the formula come a picture ('bild') and an explaining sentence.



The inspiration for the formulas came from the Leiden '**Wall poems'**. Ivo van Vulpen, who recently joined LION as extraordinary professor in Science Communication for 1 day per week, and LION researcher Sense Jan van der Molen started the formulas project in 2015, together with the foundation TEGEN-BEELD (wall poems). The basic idea is to show that science has been and is being performed by real people that have wandered and are wandering the same streets of Leiden. And that some of the ideas coming out have actually traveled all over the world since. LION has embraced the initiative as part of its outreach activities.

By now, eight wall formulas have been painted, varying from the Lorentz force and Snell's law to the concept of spin and the Oort constants. Three more are planned. Anybody in Leiden can thus bump into a scientific discovery! To satisfy the curiosity of those interested, an audiotour (on izi-travel;) and a website have been made. The latter has a Dutch, English and German variety (www.muurformules.nl; www.wallformulas.org ; muurformules.nl/?ln=de).

The response to the project has been very positive. Not only the local and national Dutch newspapers and radio have embraced the concept, also international media, such as El Pais have given it attention. There was even response from Mexico and Panama. Moreover, several Wikipedia pages in English, Dutch and German feature wall formula pictures with the physics lemmas they discuss.

The wall formula project has been awarded the NWO Communication Prize (10 k€). This money is currently used by the initiators to spread the concept to other cities in the Netherlands and Europe. Utrecht (4) and Groningen (2) have taken over the idea, albeit with their own twist. Moreover, there is a collaboration with Vienna and Prague to spread the inspiration. In fact, in Prague a first wall formula has just been unveiled.

Case Study 6: papers we are proud of.

Paper	Short description
The matter of complex anti-matter: the portrayal and framing of physics in Dutch newspapers. S. W. Kristensen, J. Cramer, A. McCollam, W. G. Reijnierse, and I. Smeets JOURNAL OF SCIENCE COMMUNICATION 20 DOI 10.22323/2.20070202 2021.	Physics is often perceived as difficult, but there has been little research on how physics is reported in the media. The paper examines the portrayal of physics in five major Dutch newspapers. It finds that Astronomy / astrophysics is the most prominent field, newspaper articles are triggered almost equally by scientific and non-scientific events, and the majority of described physics concepts are framed as difficult, but journalists do provide explanations for them.
From Dublin descriptors to implementation in Bachelor labs P. S. W. M. Logman and J. Kautz, J. Phys.: Conf. Ser. **1929** 012065.	This paper describes the renewal of the first year Physics Bachelor labs at LION towards more open inquiry labs. The paper illustrates the literature basis for the renewed setup and connects its learning objectives to the more general Dublin descriptors.
Multi-step self-guided pathways for shape-changing metamaterials C. Coulais, A. Sabbadini, F. Vink and M van Hecke, NATURE 561, 512 (2018)	This paper showed the first example of a metamaterial with a multistep shapemorphing pathway. It pushed the boundary of complexity in design, and opened a new direction towards materials with controllable pathways and embedded information processing.
Slip length dependent propulsion speed of catalytic colloidal swimmers near walls S. Ketzetzi, J. de Graaf, R.P. Doherty, and D. J. Kraft Physical Review Letters 124 (4), 048002 (2020).	In this paper we experimentally demonstrate that catalytic colloidal swimmers are strongly affected by the slip boundary condition of nearby walls, whereas other contributions stemming from electrostatics or roughness are subdominant. Our measurements furthermore provided important clues about the still debated propulsion mechanism.
O. Iendaltseva, V. V. Orlova, C. L. Mummery, E. H. J. Danen, and T. Schmidt *Fibronectin Patches as Anchoring Points for Force Sensing and Transmission in Human Induced Pluripotent Stem Cell-Derived Pericytes.*, Stem Cell Reports, **14**, 1107-1122 (2020)	In this paper we showed how pericytes, the important blood-pressure regulators in the brain, attach to the capillaries by direct imaging of the anchoring points. That paper closes a discussion which started from some EM-images 30 years ago.
Multiplexed nanometric 3D tracking of microbeads using an FFT-phasor algorithm}, T. B. Brouwer, N. Hermans, and J. van Noort, Biophysical journal 118, 2245 (2020).	This paper addresses a long-standing question on the organization of our genome at the supra-molecular level. It combines statistical physics, Brownian dynamics, advanced microscopy, and molecular biology to compare models and experiment quantitatively and with unprecedented detail. It showcases the need for tight multidisciplinary collaborations, and for specialized technical support.
Observation of the Unconventional Photon Blockade, H.J. Snijders, J. A. Frey, J. Norman, H. Flayac, V. Savona, A. C. Gossard, J. E. Bowers, M. P. van Exter, D. Bouwmeester, and W. Löffler, Phys. Rev. Lett. 121, 043601 (2018),	Editors suggestion "A Double Take on Unconventional Photon Blockade", Arxiv:1803.10992. We were able to firstly demonstrate this novel cavity-QED effect predicted more than a decade ago, possibly enabling better single photon sources in future.

Paper	Short description
Nonuniversal transverse electron mean free path through few-layer graphene, D. Geelen, J. Jobst, E. E. Krasovskii., S. J. van der Molen and R. M. Tromp Physical Review Letters 123(8): 086802 (2019).	Since the 1970s, the mean free path λ of electrons hitting a material with energy E (0-100 eV), has been believed to follow a 'universal curve' λ(E), independent of the material. Combining LEEM and eV-TEM, we accurately determine λ(E) for few-layer graphene. Our results deviate strongly from the 'universal curve', specifically where it comes to (previously ignored) quantum resonances.
Direct evidence for Cooper pairing without a spectral gap in a disordered superconductor above Tc K. M. Bastiaans, D. Chatzopoulis, J. F. Ge, D. Cho, W. O. Tromp, J. M. van Ruitenbeek, M. H. Fischer, P. J. de Visser, D. J. Thoen, E. F. C. Driessen, T. M. Klapwijk and M. P. Allan, Science 374(6567): 608-611 (2021).	This paper reports the discovery of a new quantum liquid containing electron pairs, usually associated with superconductivity, but far above Tc. This discovery required development of a completely new technique, which we expect to enable for much more progress. The work was done in collaboration with SRON and TU Delft.
Spontaneous emergence of Josephson junctions in homogeneous rings of single-crystal Sr2RuO4 Y. Yasui, K. Lahabi, V. F. Becerra, R. Fermin, M. S. Anwar, S. Yonezawa, T. Terashima, M. V. Milosevic, J. Aarts, and Y. Maeno NPJ QUANTUM MATERIALS 5, 21 (2020).	In the hotly debated issue of the order parameter of the unconventional superconductor Sr_2RuO_4, the paper shows it consists of (at least) two components, which can form domain walls and intrinsic weak links in ring-shaped mesoscopic crystals.
Evolution of the Primordial Axial Charge across Cosmic Times A. Boyarsky, V. Cheianov, O. Ruchayskiy, and O. Sobol Phys. Rev. Lett. 126, 021801 (2021)	Chiral asymmetry can spectacularly modify the electrodynamics and hydrodynamics of a system such as the Universe. We demonstrate that previous estimates of this parameter were incorrect and two orders of magnitude off. The proposed modification can materially affect the electrodynamics of the early Universe.
Doping the holographic Mott insulator T. Andrade, A. Krikun, K. Schalm, J. Zaanen, Nature Physics (14), 1049 (2018)	At the electron level, High Temperature Super-conductors are doped Mott insulators. It is not clear how the high T_c and other exotic strange metal physics ar related to the Mott state. This collaboration between string theorists and condensed matter physicists shows that strongly coupled electron physics and black holes exhibit qualitatively similar exotic physics through a holographic equivalence.
Cumulative effects in inflation with ultra-light entropy modes A. Achúcarro, V. Atal, C. Germani and G. A. Palma, J, Cosmology and Astroparticle Physics, 02 (2017) 013.	Contrary to naive expectations, we show that multifield inflation with an ultra-light extra field (such as in the axion-dilaton systems ubiquitous in string theory) gives a spectrum of primordial perturbations similar to single-field inflation and compatible with current observational bounds.
Deconfinement of Majorana vortex modes produces a superconducting Landau level, M.J. Pacholski, G. Lemut, O. Ovdat, I. Adagideli, C.W.J. Beenakker, Phys. Rev. Lett. 126, 226801 (2021).	This paper made the cover of the journal: it shows how Majorana fermions, trapped in a superconducting vortex, can become deconfined by application of a superflow. The effect may provide a "smoking gun" signature for the existence of Majorana's..