PUBLIC REPORT OF THE 2022 ANNUAL ACTIVITIES OF THE CONDENSED MATTER DIVISION (CMD) OF THE EUROPEAN PHYSICAL SOCIETY (EPS)

CMD sections

The Condensed Matter division has seven Sections:

- Liquids
- Low Temperature Physics
- Magnetism (the role of which is played by the independent European Magnetism Association, EMA)*
- Semiconductors and Quantum Materials**
- Soft Condensed Matter and Biophysics
- Structural and Dynamical Properties of Solids
- Surfaces and Interfaces

*The Division enjoys strengthened ties with the European Magnetism Association, with crossed participation of the CMD and EMA chairs in the respective Boards and Board meetings. A new agreement between EMA and CMD was signed in 2022 to continue the fruitful collaboration.

**The previous name of the “Semiconductors and Quantum Materials” section was “Semiconductors and Insulators”, but it was changed in 2022 to reflect with more fidelity the current research of the section members.

CMD Board Members List

- José María De Teresa (Zaragoza, CMD Board Chair)
- Olivier Fruchart (Grenoble, representing EMA)
- Roel Dullens (Nijmegen, representing the Liquid Matter Physics Board)
- Erich Runge (Ilmenau, elected)
- Silke Bühler-Paschen (Vienna, elected)
- Kees van der Beek (Palaiseau, EPS Executive Committee member, co-opted)
- Roberta Caruso (Naples, co-opted, representing Young Minds)
- Amina Taleb (Soleil, representing the Surface and Interface Physics Board)
- Joaquim Agostinho Moreira (Porto, representing the Structural and Dynamical Properties of Solids Board)
- Alfonso Muñoz (La Laguna / Tenerife, representing the EHPRG)
- Maria José Calderón (Madrid, elected)
- Laurence Ramos (Montpellier, representing the Soft Matter and Biophysics Board)
- Enrique Díez (Salamanca, representing the Semiconductors and Quantum Materials Board)
- Christian Enss (Heidelberg, representing the Low Temperature Physics Board)
Board Meetings in 2022

Online, March 21, 2022
Online, June 28, 2022
Online, December 12, 2022

Sections' boards composition

Soft Matter and Biophysics Section: Laurence Ramos (Chair), Nuno Araujo (Secretary), Emanuela Zaccarelli, Catherine O'Sullivan, Mikko Juhani Alava, Dimitris Vlassopoulos, Daniela J. Kraft, Anna Stradner.

Structure and Dynamics Section: Joaquim Agostinho Moreira (Chair), Wilfred Prellier (Secretary), Elena Buixaderas, Morgan Trassin, Sophie de Brion, Carmela Aruta.

Low Temperature Section: Christian Enss (Chair), Silke Bühler-Paschen (Secretary), Per Delsing, Jukka Pekola, Richard Haley, Ladislav Skrbek.

Liquid Physics Section: Roel Dullens (Chair), Cecile Cottin Bizone, Erwin Frey, Sabine Klappe, Doris Vollmer, Lucio Isa, Susan Perkin, Ignacio Pagonabarraga, Roberto Cerbino.

Surface and Interface Physics Section: Amina Taleb (Chair) and Carla Bittencourt (Secretary).

Semiconductors and Insulators Section: Enrique Díez (Chair) and Erich Runge (Secretary), Janine Splettstoesser, Zeila Zanolli, Anti-Peka Jauho, Camilla Coletti, Pina Romaniello, Stefano Roddaro, Massimo Rontani.

On the other hand, CMD also enjoys a privileged relationship with the European High Pressure Research Group EHPRG. With the signature of bilateral agreement at the EHPRG conference in 2019, EHPRG formally became an EPS Collaborating Society. There is a crossed representation of EHPRG and CMD on the respective Boards.

The CMD newsletter

The Condensed Matter Division continues to publish its newsletter (7 issues in 2022), which includes conferences, prizes, news, events, job offers and an interview of a member of the European condensed matter community. This new section is thought to be helpful to hear the voice of researchers at all stages of the scientific career whilst respecting gender balance. The (electronic) Newsletter is sent to some 6500 email addresses and all issues are stored at the EPS website: https://www.eps.org/members/group_content_view.asp?group=85187&id=688287

In some issues of the CMD newsletter, an interview to a member of the CMD community is included. In 2022, we had the honour to interview the Nobel Prize winner Prof. Klaus von Klitzing. This interview is included at the end of this report.

The presence of CMD in social networks

The Condensed Matter Division is present in the social network Twitter with the username @MatterEps. This account has 957 followers (50% more than in 2021) and follows 1050 other accounts. In 2022, we tweeted or retweeted around once per week.
Conferences organized by CMD

The General CMD29 conference, organized jointly by IOP and CMD-EPS, took place in Manchester (U.K.) from August 21st to 26th, 2022. With 5 exciting plenary talks and 11 semi-plenaries, 666 registered delegates and more than 600 contributions in 14 parallel sessions, over 5 days, CMD29 was an unforgettable conference in all fields of condensed matter physics: low-d materials, matter-cavity interactions, soft matter and bio-physics, correlated electron systems and competing orders, quantum sensing and quantum computing, materials physics … CMD29 also had boasted special round table and discussion sessions dedicated to the carbon footprint of research and new modes of conferencing, to physics publishing, and to inclusiveness and diversity in physics. Given that only 19% of registered participants in CMD29 were women, the latter session, attended by 40, underscored our resolve to defend the position of women and minorities in physics. The unforgettable 2022 Europhysics Prize ceremony took place during the conference. A few pictures of the conference are included here below.

The “Structural and Dynamical Properties of Solids” Section of the Condensed Matter Division of the EPS has organized two free online workshops under the title The EPS Structural Dynamics Afternoons. These online workshops, with an average attendance of 60 participants, contribute to foster scientific cooperation and spread of knowledge within the Structural and Dynamical properties of Solids.

EMA has organized the European School on Magnetism (ESM2022) in Saarbrücken, Germany, and the Joint European Magnetism Symposia (JEMS2022) in Warsaw, Poland.

The Institute of Physics (IOP) and CMD jointly organized the online workshop “Advances in the Casimir force and heat transfer phenomena” that took place on 15 March 2022. The overall statistics of the IOP-CMD joint online workshops organized in 2021 and 2022 is: 639 attendees, with 332 male participants, 75 female participants, and 232 who did not give gender information.
Prizes awarded in 2022

The EPS Europhysics Prize is arguably Europe’s most prestigious prizes in the field of condensed matter physics. It is awarded in recognition of a prominent and well-identifiable discovery, breakthrough, or contribution to condensed matter physics, by one or more individuals, contribution that, in the opinion of the Society’s selection committee, represents scientific excellence. The award may be given for either pure or applied research at the discretion of the Society. The award recognises research for which a significant portion of the work was carried out in Europe. In 2022, this is the summary of the nominations: 31 candidates were proposed (24 male and 7 female). The countries where the nominees work were: France (9), US (7), Germany (4), Spain (3), The Netherlands (3), Austria (1), UK (1), Italy (1), Switzerland (1), Luxembourg (1). The 2022 Prize winners were: Prof. Agnès Barthélémy and Dr. Manuel Bibes (CNRS/Thales laboratory of University Paris-Saclay), Prof. Ramamoorthy Ramesh (UC Berkeley) and Prof. Nicola Spaldin (ETH Zurich), for “seminal contributions to the physics and applications of multiferroic and magnetoelectric materials”.

Equality, Diversity and Inclusion Policy

It is CMD policy that in all the conferences organised by or promoted by the Division and its sections, care is taken to look first for possible female invited speakers. In the last CMD conferences, our target of 50% of female plenary/semiplenary speakers has been mostly achieved. Topical diversity and country diversity is also taken into account in the choice of speakers in conferences organized by the CMD. The CMD Board has 5 women.

Special activities in 2022

- CMD has supported Ukraine after Russia’s attack. CMD has endorsed the EPS statement on this topic and has included several paragraphs in the CMD newsletters. An interview with an Ukrainian physicist has been included in the CMD newsletter in March (https://mailchi.mp/eps/eps-cmd-newsletter-n-46-may-5699237?e=74b744aaf6).
- CMD contributions have been made to the EPS Grand Challenges Physics for Society in the Horizon 2050, coordinated by Kees van der Beek (for the chapter on “Physics of Light and Matter”) and Carlos Hidalgo (Editor-in-Chief).

Work plan for 2023

- Election of new CMD board members (3) plus up to 3 new co-opted members.
- Participation in Grand Challenges document: proofs review.
- Europhysics Prize 2023. The call for nominations is open until the end of February.
- Organization of CMD30 conference in Politecnico de Milano (September 2023).
- Start the organization of the CMD31 conference (to be held in 2024).
- CMD Newsletters (6 issues are foreseen in 2023)
- Email alerts to the CMD community on specific events
- Presence in Twitter: increase the number of followers by 10% (target) and tweet once weekly.
ANNEX: INTERVIEW WITH PROF. KLAUS VON KLITZING  
(by the CMD Board Chair)

Biography:
I was born in Schroda which was part of Germany at the time of my birth and is now Polish territory. The fact that a large marble plaque at the hospital in Środa Wielkopolska commemorates my birth on 28.06.1943 shows that living together in Europe works and that my self-conception of scientific cooperation without political and ideological barriers bears fruit. In spring 1945, The Great Escape to the West to flee the Soviet invasion ended in Oldenburg, where I also started school. After my studies in Braunschweig and my doctorate and habilitation in Würzburg as well as various stays abroad (especially in Grenoble, the birthplace of the quantum Hall effect), I was appointed to the TU Munich in 1980. Shortly before the Nobel Prize in 1985, I became Director at the Max Planck Institute for Solid State Research in Stuttgart, where I am still active today as Emeritus Professor.

J.M.D.T. This is always the first question in my interviews for the CMD newsletter. Can you summarize your scientific trajectory? Which are your main research achievements?

K.V.K. My scientific career probably began in pre-school age, when I earned my first pocket money by helping my father to add up columns of numbers. Mathematics was my strength and in elementary school, where four grades were taught at the same time in one classroom, I was asked by the teacher to solve the mathematical problems of the higher grades. So it was clear to me that I wanted to study mathematics. But only six months after starting my studies at the Technical University of Braunschweig, I realized that a practical application of mathematics in physics is much more interesting than pure dry mathematics, and so I ended up in physics, especially semiconductor physics, which was the most modern topic in physics at this time. Braunschweig played a very special role in my scientific career because I regularly worked in the semester breaks at the metrology institute there, the Physikalisch Technische Bundesanstalt, and thus became familiar with high-precision measurements in a wide variety of fields, including high-precision measurements of electrical resistances. There I also met my mentor Gottfried Landwehr, who dealt with low-temperature physics, superconductivity and semiconductors in strong magnetic fields. I did my doctorate and habilitation with him in Würzburg and learned infrared spectroscopy as a post-doc in the group of Tony Stradling in Oxford. Research stays at the Boltzmann Institute in Vienna and at the École Normale Supérieure in Paris extended my portfolio in semiconductor metrology to include time-resolved and microwave methods. A turning point in my scientific career was initiated by my experimental observation that the electrical resistance of a tellurium sample can be drastically changed by different etching processes. This is how I entered the field of semiconductor physics at interfaces and surfaces where two-dimensional electron gases are formed and my department at the Max Planck Institute for Solid State Research was consequently named "Low Dimensional Electron Systems". The most important scientific achievements of my team were therefore mainly in the field of quantum transport in low-dimensional electron systems with
pioneering work in the field of quantum dots, electron and nuclear spin investigations in these
systems as well as the discovery of novel phenomena that were recently awarded the EPS Edison
Volta Prize.

J.M.D.T. However, this is the first time that I ask the next question. You were awarded the
Nobel Prize in Physics in 1985 for the discovery of the quantized Hall effect. It is common
that the Nobel Prize is shared by several researchers contributing to the topic or working in
the same group... can you comment on the intra-history* of your discovery? Were there
theoretical predictions of the effect or you were inspired by previous work? Did you have the
support of other colleagues to perform this work? (*The Spanish philosopher Unamuno
introduced the concept of “intra-history” to highlight the role played by peripheral actors in
History).

K.V.K. In fact, I am the only living Nobel Prize winner in physics who received the prize unshared.
Since the quantum Hall effect was a chance discovery, there was no organized team aiming at a
Nobel Prize worthy goal like gravitational waves or the Higgs Boson. I was just lucky enough to
discover something qualitatively new, an electrical resistance which depends exclusively on
fundamental constants. Nobody expected that transport measurements on a silicon MOSFET with
alloyed contacts, impurities, and undefined geometry could produce such a fundamental
result. The discovery of the quantum Hall effect was purely experimental, based on the
observation, that devices fabricated at different companies (Siemens and Plessey) showed small
anomalies at the same value of the Hall resistance. My decision to look in more detail in this
anomaly was the birth of the quantum Hall effect. This was at the high magnetic field laboratory
Grenoble at 2 a.m. on the night of 4th to 5th February 1980. My experience in high precision
measurements allowed me to confirm within just a few hours that the observed anomaly agreed
with high precision with the fundamental resistance h/e², where h is Planck’s constant and e the
elementary charge. This fact refuted the previously accepted notion
that the localized electron
states that exist due to unavoidable disorder in the tails of Landau levels do not influence the value
of the observed Hall plateaus.

J.M.D.T. Are there any anecdotes you can tell us about the Prize ceremony or all the fuss
that came afterwards? How did this prize change your life, in a positive or negative way?

K.V.K. The award ceremony is a very formal event with rehearsals and exact instructions on how
to behave during the award presentation. Since my three children were relatively young, exact
plans were made to keep my three-year-old son occupied during the award ceremony with a
limousine and driver provided by the State Department and a children’s nurse so that the event
would not be disrupted. However, after the press learned that my son was the youngest attendee at
a Nobel Week, he had to sit in the middle of the front row in the theater with his siblings and all
the television cameras focused on him, especially as he fought with his sister for the right to use
the armrest. He stole the show. Since the Nobel Prize is the highest scientific award, it naturally
has an influence on life afterwards. The biggest problem for all laureates is the expectation that
Nobel Prize Winners should know everything and can give a competent answer to any problem,
even outside their own field of work. Of course, this is not the case. On the other hand, the public
has a great interest in receiving opinions on important problems from recognized scientists who
are not suspected of being lobbyists. I therefore do not avoid the responsibility of taking a public
position on fundamental issues. In this respect, I am involved in the issue of climate change
because, as a Nobel laureate, I am a member of many scientific academies and, through contacts
with high-ranking scientists, you can assess the factual situation well and, as a recognized
multiplier, inform the public in an unbiased manner. In addition, photovoltaics as a subfield in
condensed matter physics plays an extremely important role as a renewable energy source so I am not an outsider if I make publicity for solar energy.

J.M.D.T. When did you find out that you were passionate about Science and/or Physics? Were you inspired by your family, teachers, books, role models or by Nature? Can you provide any advice to young students who feel the bite of Science?

K.V.K. I already mentioned that I was interested in numbers and mathematics at a very early age. In contrast, German and foreign languages were torture for me. Parents and teachers are probably the most important people who can recognize and encourage a child's interests. My mother, as a chemical-technical assistant, probably passed on to me an interest in the natural sciences, and my father's profession as a forester also encouraged my curiosity to understand nature and to ask questions. However, a very important role was played by a mathematics/physics teacher in high school. He brought out my enthusiasm for these subjects and my grades in these subjects improved drastically because of this motivation. In order to encourage the commitment of teachers in science subjects, who also devote their free time to the advancement of pupils, I am the cofounder of the annual Klaus von Klitzing Prize for exceptionally engaged teachers in STEM education, which is supported by the University of Oldenburg and the EWE Foundation. If I had to give advice to young students, I would say that the most important thing is enthusiasm for the work. Also, in scientific research, internationality, cooperation and communication are very important. It is a privilege for scientists to work globally and I recommend my young scientists to change location after about 5 years to gain new experiences.

J.M.D.T. Do you think that significant progress in Science is made by advancing small steps every day or through paradigm shifts carried out by a few geniuses?

K.V.K. For me as an experimental physicist working in basic research, the challenge is to break new ground in small steps with the most modern instruments and measurement methods and the knowledge of experimental facts of other groups and new theoretical developments. If you are lucky, you contribute to a quantum leap. In my experimental research work I am not driven by exciting new theoretical models with the goal to be the first one to publish experimental data which may contribute to a hot topic. There is a danger of being biased in favor of the most spectacular interpretation and disregarding all other established interpretations. Unexplained experimental observations are the driving force for surprises in condensed matter physics, and it is important to have the freedom to change one's research direction in case of unexpected observations. In this respect, I am committed to maintaining freedom in basic research, as is practiced at the Max Planck Society

J.M.D.T. Are you in favor of syllabus at University that specializes the student in a single field, such as Physics, or the U.S. University style with major and minor degrees in more than a single field? How important is interdisciplinarity to solve the key technological problems of our society and how can we favor it?

K.V.K. During my studies in Germany, I had the opportunity to acquire specialist skills in other areas in addition to studying physics. What is important, however, is that you acquire a deep understanding of one area and then transfer your special knowledge to another area. In this respect, interdisciplinarity is very important. To do this, however, a relationship of trust must be established between two specialists who develop visions in regular personal contacts. Communication is a success factor in solving essential problems.
J.M.D.T. Please, tell us your opinion on what are the most exciting research topics in Condensed Matter Physics today, from your personal point-of-view.

K.V.K. For me, two-dimensional electron systems are still the most interesting research objects in solid state physics. Quite apart from the fact that just in recent years the discovery of novel magnetic and superconducting phases in twisted bilayer graphene caused a sensation, 2-dimensional systems allow the discovery of novel physical phenomena. Only in 2-dimensional systems is it possible to study anyons in addition to bosons and fermions, which also allow access to the topological quantum computer.

J.M.D.T. In your view, what are the challenges faced by Europe to maintain a leading position in Science and Technology with respect to U.S. and China? Can you share some piece of advice to reinforce the European position?

K.V.K. Europe has lost weight worldwide, especially due to Brexit and too many self-interests of various states, and is not seen as a political entity. It lacks the dynamism and spirit of optimism that can be observed in China, for example. The Ukraine war was even a push to send Europe into irrelevance, to destroy the vision of a strong, united Europe. I hope that the Russian-instigated war in Europe will lead to Europe moving closer together and advocating a common strategic research and industrial policy. Europe is falling behind the world, particularly in digitization.

J.M.D.T. In your view, how relevant are scientific associations for young and senior scientists today? What is your opinion about the European Physical Society and the European national Physical societies, compared for example to the American Physical Society?

K.V.K. In an age of an oversupply of fake conferences, it is particularly important that scientific associations offer a wide range of serious conferences and strengthen interactions and collaborations between scientists. Since there are many strong national physical societies in Europe, the EPS, in contrast to the APS, is not viewed from the outside as an outstanding European scientific society. Here, too, Europe must grow closer together.

J.M.D.T. Faced with a complex world, human beings tend to oversimplification. In a few short words, how would you like that future generations of Physicists remember you?

K.V.K. I am not worried about how future generations will remember me. At least part of my scientific work has become immortal thanks to the von Klitzing constant $R_K = \hbar/e^2$ introduced worldwide as part of our international system of units with a value fixed for eternity, and that is perhaps the highest that a scientist can achieve.

J.M.D.T. Free text…express yourself!

K.V.K. Competition, especially in basic research, has increased to such an extent that fruitful and critical discussion of unpublished results is no longer sufficiently cultivated and the common goal of generating new knowledge is no longer in the foreground. Speculations and even fraud play an increasing role in publication submissions. Egoism is not the way to solve the great problems of mankind.