



**Joint Annual Meeting of the
AUSTRIAN PHYSICAL SOCIETY
SWISS PHYSICAL SOCIETY**

Award Ceremony

Mittwoch 1. September 2021, 10:50 — Mercredi 1. septembre 2021, 10:50

**Innsbruck
Raum A**



ÖPG honorable recognition (Division Physics and School)

Honorable recognitions for outstanding pre-scientific work (Vorwissenschaftliche Arbeit - VWA) carried out in the field of physics by pupils. Honorable recognitions for the participation at the International Young Physicists' Tournament 2021 and for the participation at the European Physics Olympiad 2021 and at the International Physics Olympiad 2021.

ÖPG Schüler:innen Preis (Division Physics and School)

Prizes for outstanding pre-scientific work (Vorwissenschaftliche Arbeit - VWA) carried out by pupils in the field of physics.

Students' Award of the ÖPG (Workgroup Young Minds)

The ÖPG students' award is used to honor outstanding master's and diploma theses in the field of experimental or theoretical physics. All graduates who have usually completed their physics degree within the last year are addressed.

Victor Franz Hess-Preis (Division Nuclear and Particle Physics)

The Division Nuclear and Particle Physics of the ÖPG awards the Victor Franz Hess Prize for outstanding dissertations in the field of nuclear and particle physics. The aim of the award is to promote young scientists and to stimulate the scientific activities of the division.

Roman Ulrich Sexl-Preis

The Austrian Physical Society awards the Roman Ulrich Sexl Prize with the aim of promoting motivating and efficient physical education. The achievements to be recognized can be provided in teaching, in lesson planning and delivery at any level of knowledge, in the context of teacher training, adult education or in the creation of teaching aids of all kinds.

Physik-Preis der ÖPG (Fritz Kohlrausch-Preis and Ludwig Boltzmann-Preis)

The Physics Prize of the ÖPG, which is to be awarded at most once a year, alternately as the Fritz Kohlrausch Prize for an experimental achievement and the Ludwig Boltzmann Prize for a theoretical achievement, serves the aim of promoting young talents. An excellent scientific work from the entire field of physics, which should have been published in the last two calendar years, is eligible for the award.

EuPhO 2021

- European Physics Olympiad
- online competition 19th-20th June 2021
- organized by Estonia
- School Team:

Elias Hohl (Stmk.)	Gold, overall ranking 10/220
Moritz Hofer (S)	Bronze
Joensuu Miro (K)	<i>Honourable Mention</i>
Laurin Pfundner (W)	<i>Honourable Mention</i>
Rohan Walia (K)	<i>Successful Participation</i>

- Team Leader: Marianne Korner



IYPT 2021



AUSTRIAN YOUNG PHYSICISTS'
TOURNAMENT

- International Young Physicists' Tournament
- Face-to-face competition in Georgia
- 07th-14th July 2021
- 15 Teams
- **Team Austria – Gold medal**

Jeremias Costa

Simon Gfreiner

Rohan Walia

Haolei Zhang

Joensuu Miro – *Special price for the **Best Opponent***



Team Leader: Anatol Beck

Paul Worm

IPhO 2021



- International Physics Olympiad
- Online competition, 18th-21st July 2021
- organized by Lithuania
- Schoo Team:

Elias Hohl (Stmk.)
 Moritz Hofer (S)
 Joensuu Miro (K)
 Markus Rainer (S)
 Rohan Walia (K)

Gold, overall ranking 27/380
Honourable Mention
Honourable Mention
Honourable Mention
successful participation

- Teamleader: Marianne Korner, Stefan Lorbek



ÖPG Schüler:innen Ehrenvolle Anerkennung 2021

The division Physics and School of the Austrian Physical Society awards the ÖPG Schüler:innen honorable recognition 2021 for outstanding pre-scientific work in the field of physics to

Johanna C. Berger: *The CAST experiment at CERN*

Miro Joensuu: *A theoretical and experimental investigation of the “Looping Pendulum” phenomenon*

Maximilian Poehacker: *Investigation of the orbital motion of the Galilean moons of Jupiter and analysis of the data obtained*

Cornelia Shtepani: *Photoelectrochemical water splitting with a focus on lanthanum titanium oxynitride photoanodes*

ÖPG Schüler:innen Preis 2021

The division Physics and School of the Austrian Physical Society confers the ÖPG Schüler:innen Preis 2021 for outstanding pre-scientific work in the field of physics to

Lucas Hörl (Bischöfliches Gymnasium Graz): *Investigation of quantum phenomena on superconductors: production and characterization of yttrium barium copper oxide*

Julius Hussl (BG BRG 4 Wien): *Influence of parameters in the 3D printing process “Fused Deposition Modeling (FDM)” on the tensile strength of 3D-printed objects*

Ida Stettner (Akademisches Gymnasium Graz): *Modeling of phantom traffic jams*

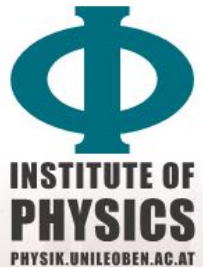
Students' Award of the ÖPG 2021

The workgroup Young Minds of the Austrian Physical Society confers
the Students' Award of the ÖPG 2021 to

Dipl-Ing. Sebastian Stock

for his master thesis

“The potential of biomass-derived activated carbons for hydrogen storage”



The potential of biomass-derived activated carbon for hydrogen storage

Dipl. -Ing. Sebastian Stock



Acknowledgments

Institute of Physics:

Oskar Paris, Gerhard Popovski, Rainer Lechner

Department Materials Science:

Nikolaos Kostoglou, Christian Mitterer

Institute of Bioproducts and Paper Technology:

Stefan Spirk, Julian Selinger

National Center for Scientific Research Demokritos:

Christos Tampaxis, Georgia Charalambopoulou,
Theodore Steriotis



DEMOKRITOS
NATIONAL CENTER FOR SCIENTIFIC RESEARCH

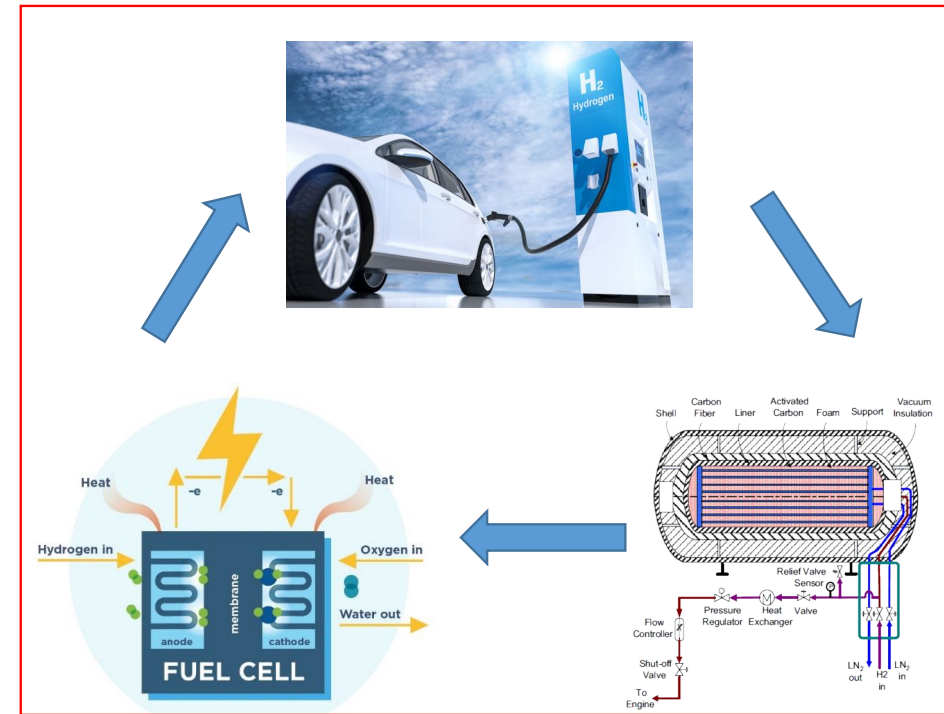
ERGEBNISSE*

Ihr persönlicher Earth Overshoot Day (Erdüberlastungstag) ist:

03. Mai ⓘ

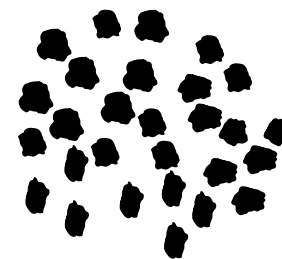
Wenn alle wie Sie leben würden, bräuchten wir

3 Erden ⓘ



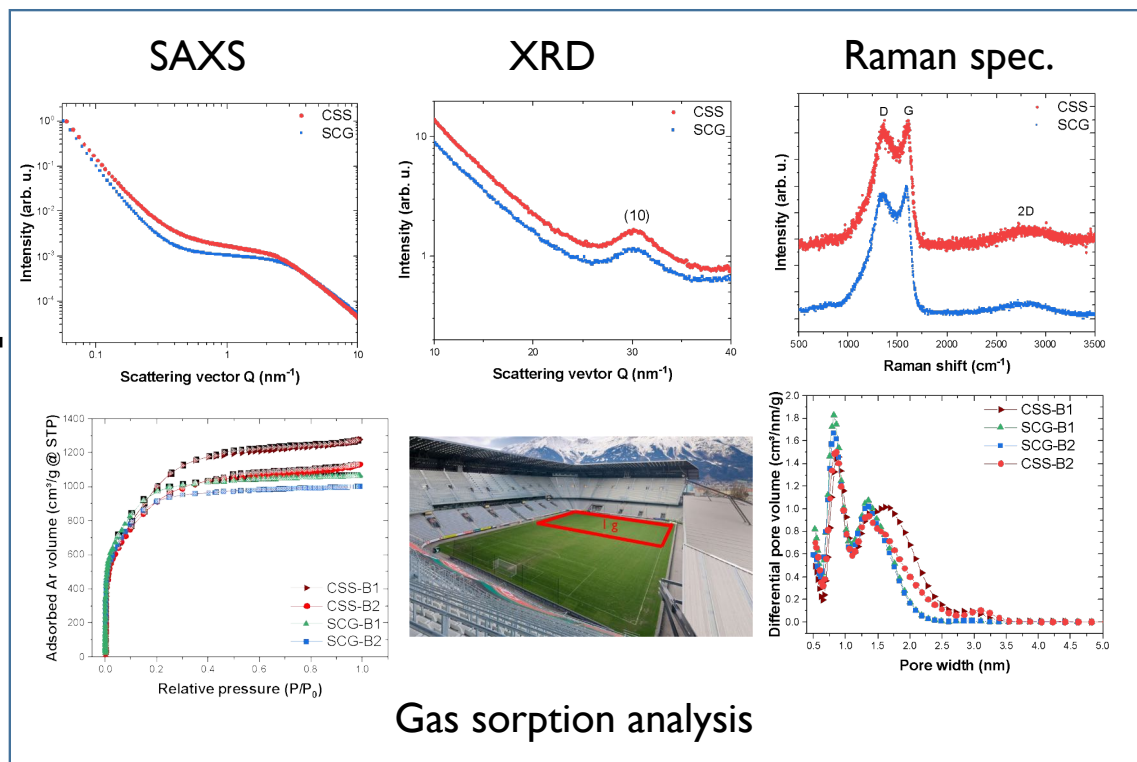
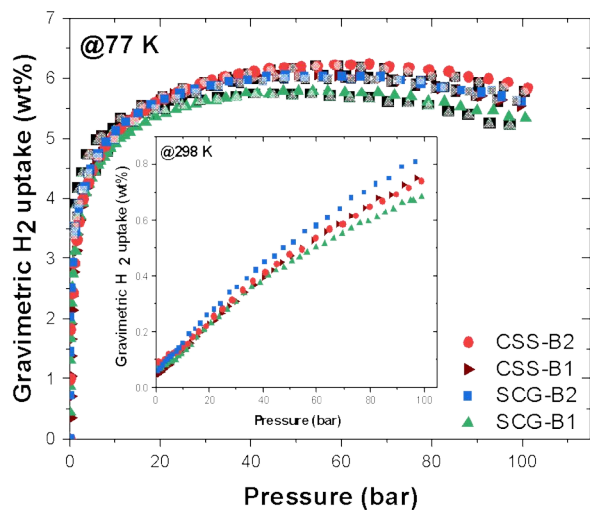
Carbonization and activation



Activated carbon powder

Structural characterization

Hydrogen uptake performance



DEMOKRITOS
NATIONAL CENTER FOR SCIENTIFIC RESEARCH



Students' Award of the ÖPG 2021

The workgroup Young Minds of the Austrian Physical Society confers
the Students' Award of the ÖPG 2021 to

Dipl-Ing. Maximilian Schober

for his master thesis

“Spin and Valley Local Field Factors for Polarised Electron Layers”

Spin and Valley Local Field Factors for Polarised Electron Layers



Maximilian Schober

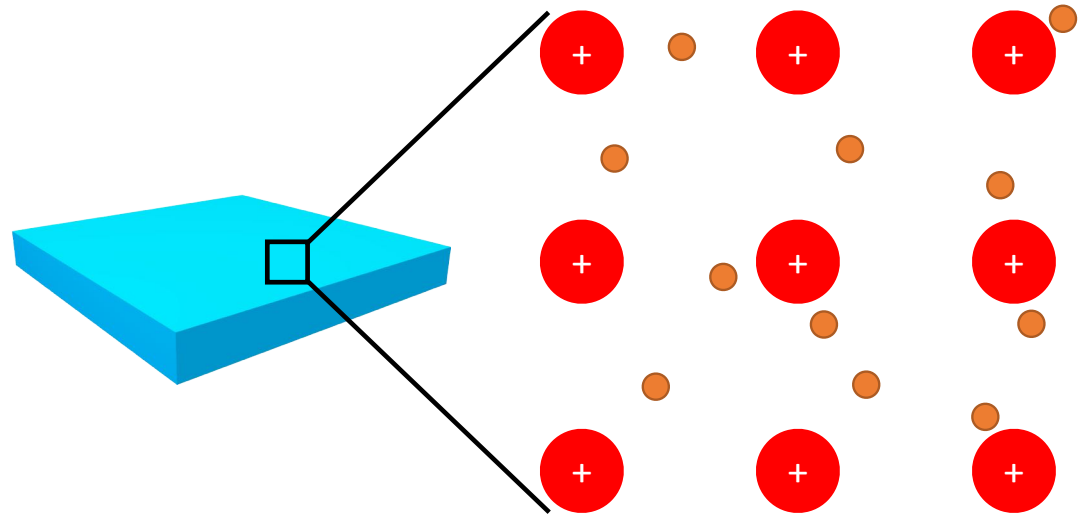


Electrons

... where to find them

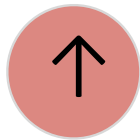
... what they are doing

... and why they are interesting

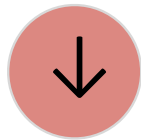


Plus

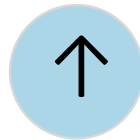
Minus



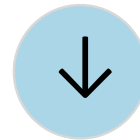
Up



Down

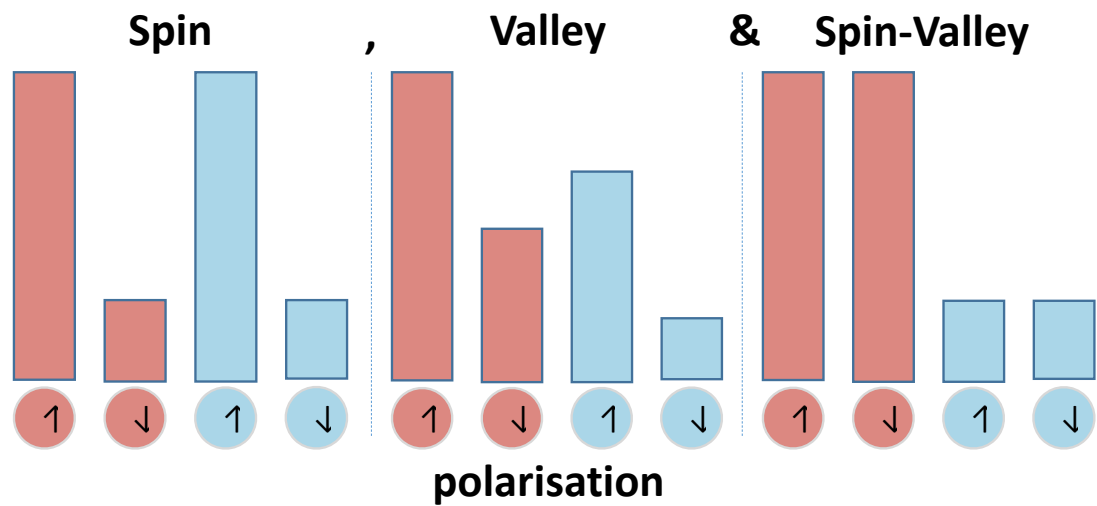


Up

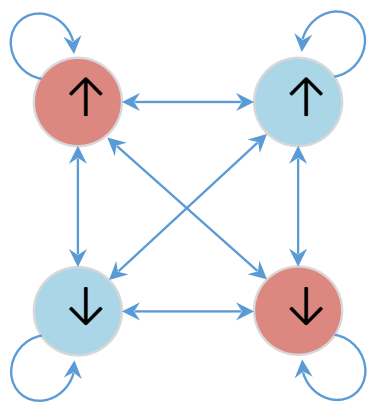
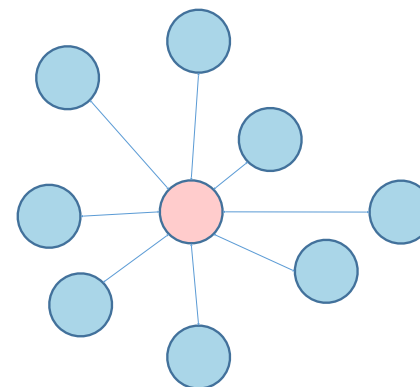


Down

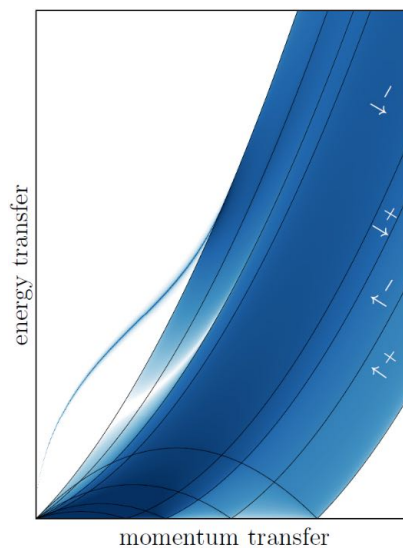
Spins, Valleys and Spin-Valleys



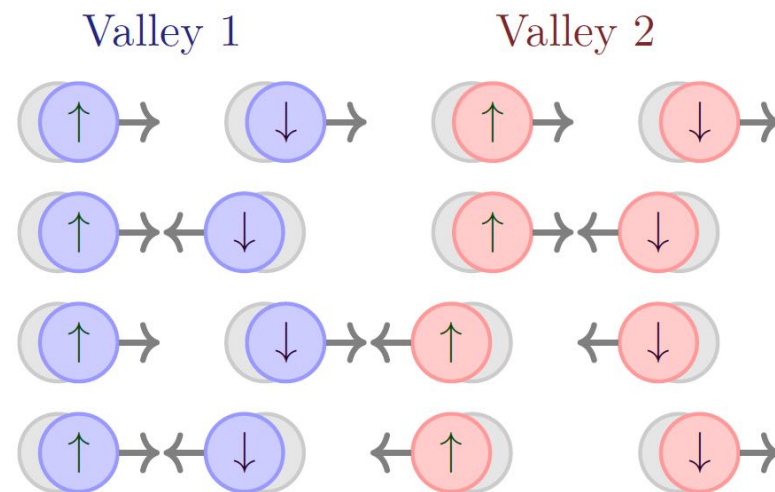
Interactions of many electrons



10 different Local Field Factors



(collective) excitations



Victor Franz Hess Prize 2020

The division Nuclear and Particle Physics of the Austrian Physical Society
awards

the Victor Franz Hess Prize 2020 to

Dr. Thomas Madlener

for his dissertation

“Measurement of the prompt χ_{c1} and χ_{c2} polarizations at CMS” .

Measurement of the χ_{c1} and χ_{c2} polarizations at CMS

OePG SPG Jahrestagung 2021

Thomas Madlener*



Sep 01, 2021

*supported by

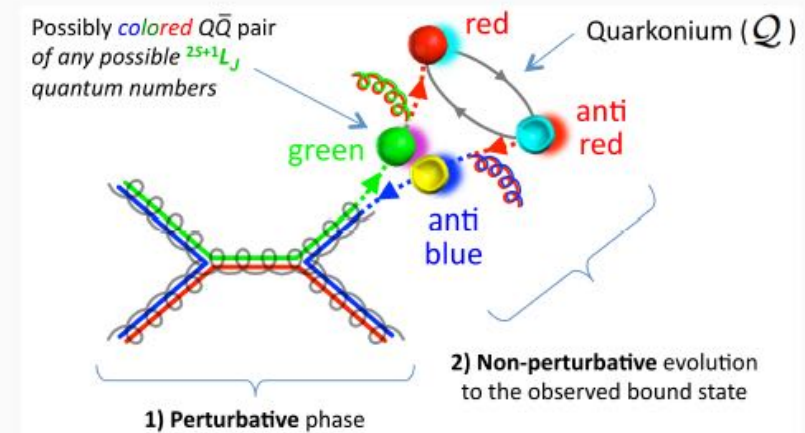
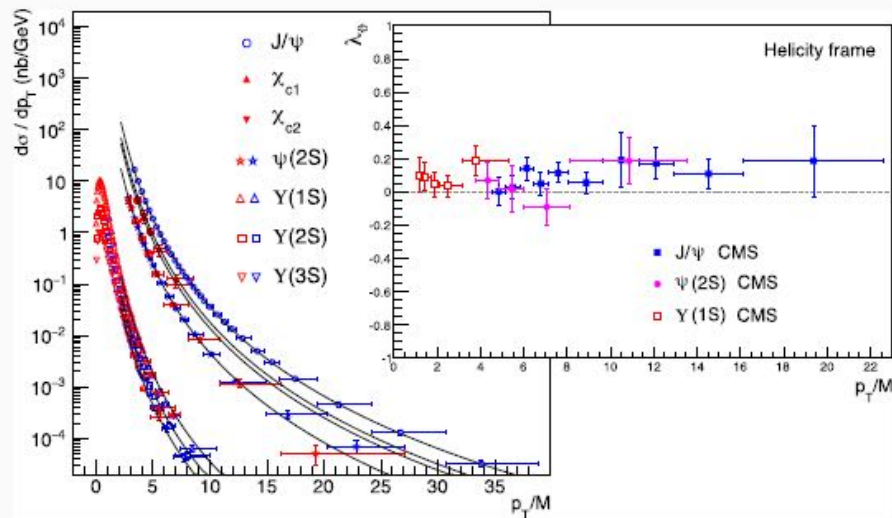
Austrian Science Fund (FWF): P28411-N36

Wednesday, 01.09.2021, Room B

Time	ID	CHIPP Award; ÖPG Viktor-Franz Hess Awards 2021 + 2020
14:50	323	Measurement of the prompt χ_{c1} and χ_{c2} polarizations at CMS <i>Thomas Madlener</i>

χ_c polarizations - What is it all about?

- Hadron formation not yet fully understood
- Quarkonia are ideal testbed
- Currently prevalent NRQCD theory requires experimental inputs
 - Cross sections and polarizations

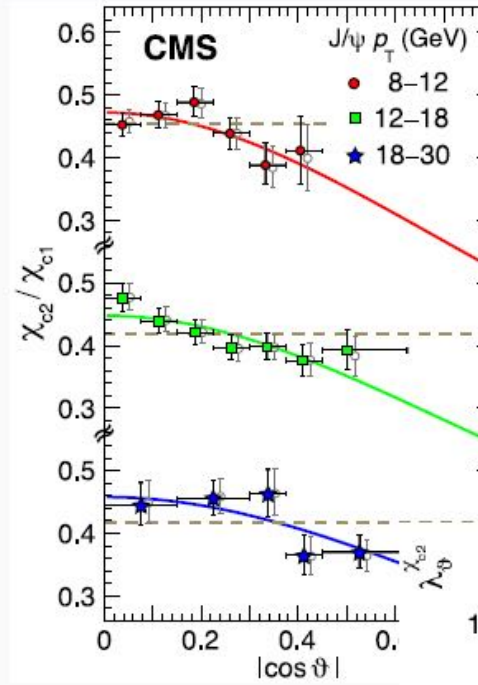


- LHC experiments provided many quarkonium measurements
- First measurement of P-wave quarkonium polarization

Results - How did we measure?

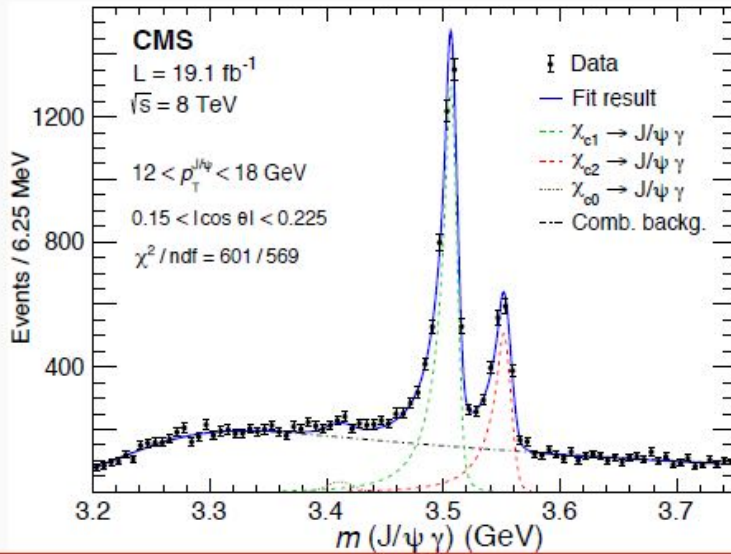
- Polarization affects angular decay distribution
 - So do various detector effects
- Solution: relative measurement

$$R(\cos \vartheta | \lambda_{\vartheta}^{\chi_{c2}}, \lambda_{\vartheta}^{\chi_{c1}}) \propto \frac{1 + \lambda_{\vartheta}^{\chi_{c2}} \cos^2 \vartheta}{1 + \lambda_{\vartheta}^{\chi_{c1}} \cos^2 \vartheta}$$

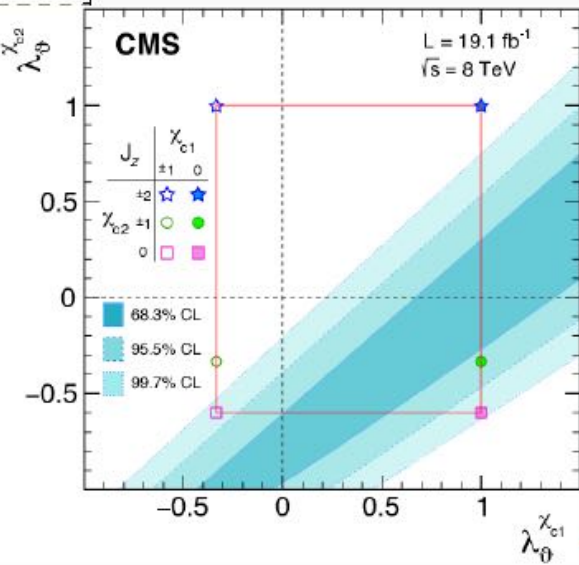


← Yield ratios vs $|\cos \vartheta|$ from fits

↓ Constraints on $\lambda_{\vartheta}^{\chi_{c2}}$ vs $\lambda_{\vartheta}^{\chi_{c1}}$



First measurement of significantly polarized quarkonium states





Victor Franz Hess Prize 2021

The division Nuclear and Particle Physics of the Austrian Physical Society
awards

the Victor Franz Hess Prize 2021 to

Dr. Frederic Brünner

for his dissertation

“Glueballs and gauge/gravity duality:
unraveling the mysteries of the (strong) force” .



Dissertation:

**GLUEBALLS AND
GAUGE/GRAVITY
DUALITY
UNRAVELING THE MYSTERIES
OF THE (STRONG) FORCE**

by Frederic Brünner

Work based on research at TU Wien in collaboration with
Josef Leutgeb, Denis Parganlija, and Anton Rebhan

Wednesday, 01.09.2021, Room B

Time	ID	CHIPP Award; ÖPG Viktor-Franz Hess Awards 2021 + 2020
14:30	322	Glueballs and Gauge / Gravity Duality <i>Frederic Brünner</i>

Summary:

A study of the properties of glueballs, bound states of gluons, making use of gauge/gravity duality.

- **Problem:** identify glueballs among the experimentally observed spectrum of hadrons.
- **Method:** gauge/gravity duals maps strongly coupled gauge theory problem to a weakly coupled theory of gravity.
- **Main result:** predictions for glueball decay rates that can be compared with experimental data, for example in *FB*, A. Rebhan, *Phys. Rev. Lett.* **115** (2015).



Roman Ulrich Sexl Prize 2020

The Austrian Physical Society awards
the Roman Ulrich Sexl Prize 2020 to

Prof. Mag. Nikolaus Unterrainer

for his contributions to motivating and efficient physics teaching.

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Roman Ulrich Sexl-Preis und ÖPG Schüler:innen Preis 2020



Da die traditionelle Preisverleihung im Rahmen der ÖPG Jahrestagung der Ausbreitung des Corona Virus zum Opfer gefallen war, wurde diese nun in einem Online-Meeting nachgeholt. Folgende Preise wurden dabei vergeben:

Roman Ulrich Sexl-Preis

Mag. Nikolaus Unterrainer, Universität Salzburg

ÖPG Schüler:innen Preise 2020

für herausragende Vorwissenschaftliche Arbeiten:

Roman Ulrich Sexl Prize 2021

The Austrian Physical Society awards
the Roman Ulrich Sexl Prize 2021 to

Prof. Dr. Mag. Ilse Bartosch

for her contributions to motivating and efficient physics teaching.

Dr. Ilse Bartosch



- 1973 **Matura** (A-level certificate) Gymnasium und Realgymnasium für Mädchen 1100 Wien (graduation with distinction)
- 1977 **Teaching Diploma** for Physics and Mathematics University of Vienna (finals with distinction)
- 1978-2020 **Teacher** for mathematics and physics (Vienna, Brigittenauer Gymnasium)
- Since 1997 **Teacher Education** (pre-service and in-service) University of Vienna, University of Klagenfurt – Project IMST Teacher education Colleges in Austria
- 2007-2011 **Studies in Pedagogy (PhD)** University of Klagenfurt (graduation with distinction) Doctoral thesis: *“Learning Physics and developing a female identity – a contradiction?”*
- 2009-2020 **Physics teacher education and physics education research** University of Vienna
- 2020 **Guest Professor University of Graz** (Aigner-Rollett Professur) Gender and Science Education
- PRICES Dr. Maria Schaumayer Preis
Käthe Leichter Preis
Global Energy Award (Youth, Vienna)
Bildung für Nachhaltige Entwicklung – Best of Austria 2016

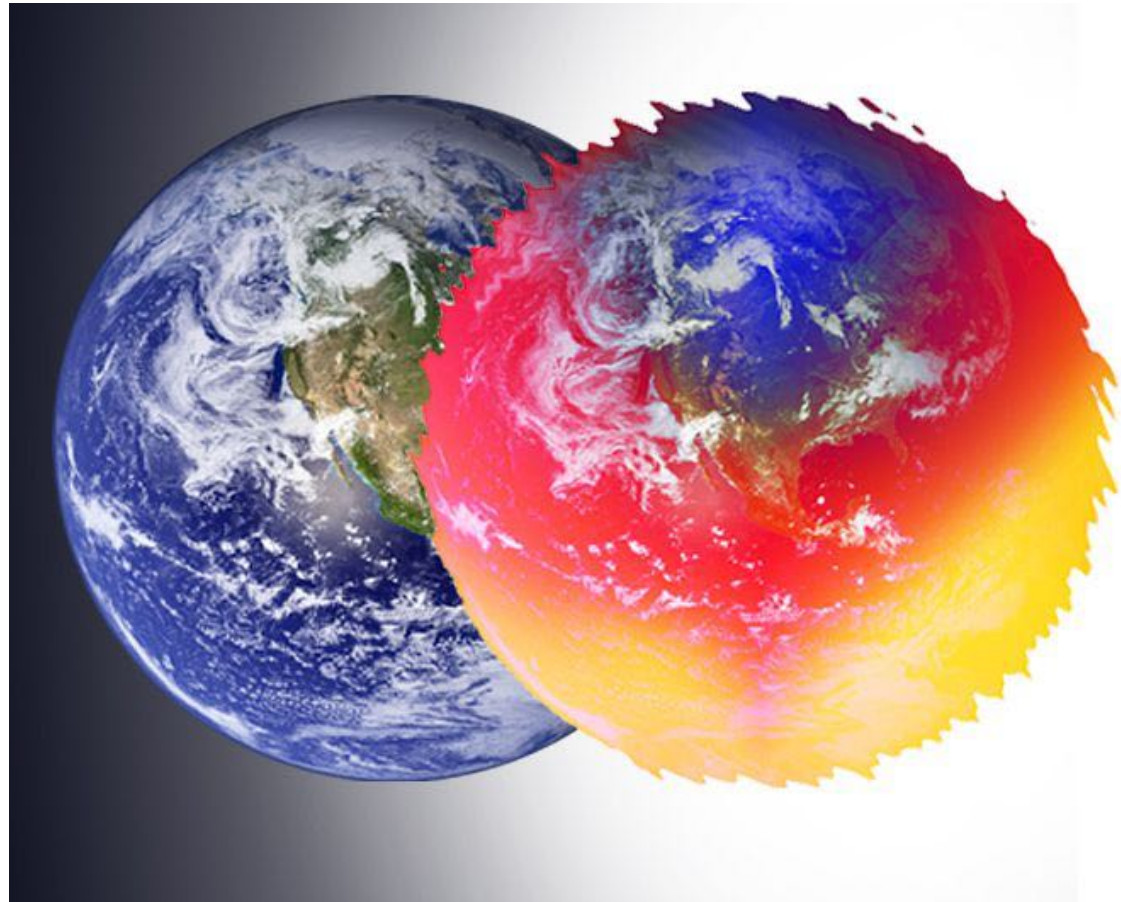
Wednesday, 01.09.2021, Room G

Time	ID	ÖPG Sexl Award
14:00	801	Naturwissenschaftliche Bildung für unsere gemeinsame Zukunft im Licht des aktuellen MINT-Hypes – eine fachdidaktische Perspektive <i>Ilse Bartosch</i>

Naturwissenschaftliche Bildung für unsere gemeinsame Zukunft

A perspective of
Physics Education Research on the
Goals of Science „Education“ (Bildung)

- Teaching for understanding
- Teaching for citizenship
- Teaching for equity
- Teaching for sustainable development



<https://i.unu.edu/media/ourworld.unu.edu-en/article/2446/dennis-meadows.jpg>

Fritz Kohlrausch Prize 2020

The Austrian Physical Society awards
the Fritz Kohlrausch Prize 2020 to

Dr. Karin Hain

for the first measurement of $^{233}\text{U} / ^{236}\text{U}$ isotope ratios in natural archives of emissions from the civil nuclear industry and of nuclear weapons tests, and its application to the study of environmental processes.



universität
wien



$^{233}\text{U}/^{236}\text{U}$ signature allows to distinguish thermal reactor emissions from weapons fallout in the environment



Karin Hain

P. Steier, R. Eigl, M. B. Froehlich, R. Golser, X. Hou, J. Lachner,
J. Qiao, F. Quinto, A. Sakaguchi

01.09.2021

K. Hain, et al., Nat Commun 11(2020), 1275.

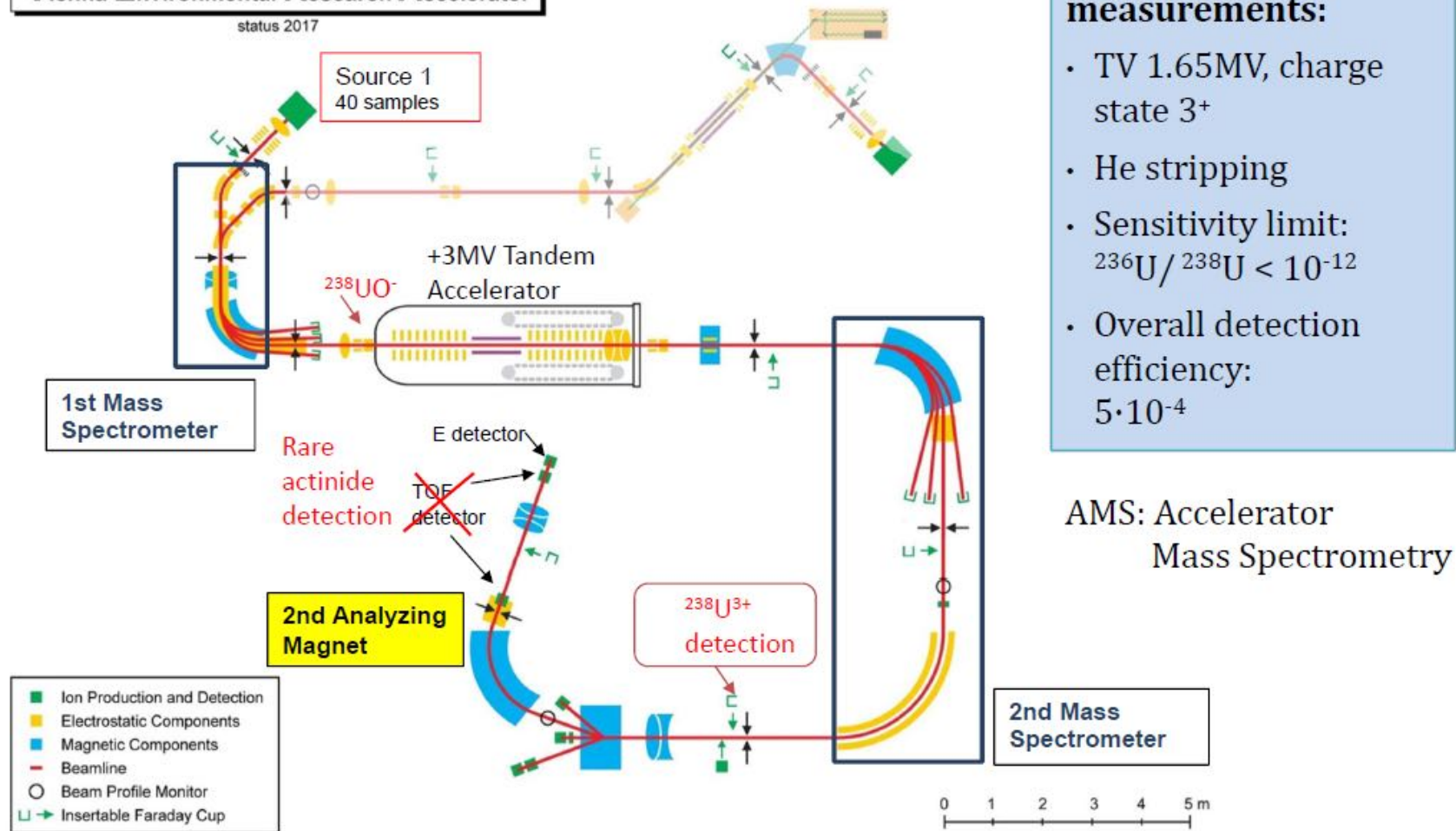
Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by COMSOL Multiphysics GmbH; ÖPG Kohlrausch Awards 2020
12:15	13	$^{233}\text{U} / ^{236}\text{U}$ signature allows to distinguish thermal reactor emissions from weapons fallout in the environment Karin Hain

AMS Setup at VERA

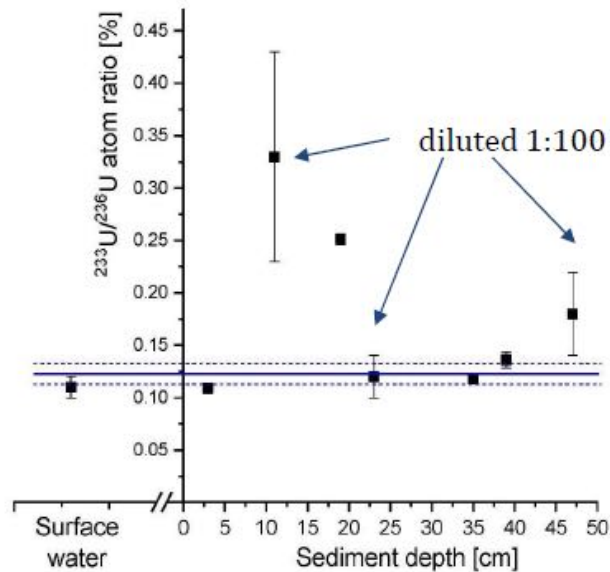
Vienna Environmental Research Accelerator

status 2017



$^{233}\text{U}/^{236}\text{U}$ signatures detected in the environment

Irish Sea: nuclear reprocessing



$$^{233}\text{U}/^{236}\text{U} = 0.13 \pm 0.02 \%$$

Dated Sellafield Sediment core

P. Steier et al, 2013, *NIM B*

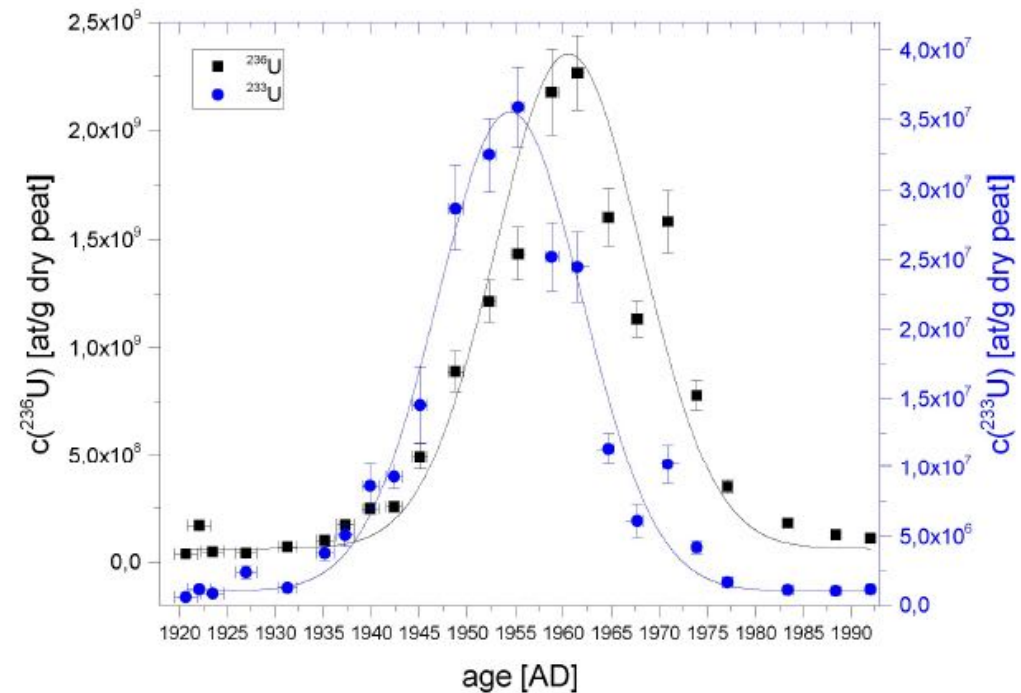
M. Srncik et al, 2011, *J. Environ. Radioact.*

IAEA-381: Irish Sea Water (1993)

Peat bog: global fallout

Samples from Black Forest (Germany)
prepared by F. Quinto, INE (KIT)

$$^{233}\text{U}/^{236}\text{U} = 1.5 \pm 0.2 \%$$



Fritz Kohlrausch Prize 2020

The Austrian Physical Society awards
the Fritz Kohlrausch Prize 2020 to

Dr. Aleksandar Matković

for the experimental achievements in connection with
needle-like organic crystals on two-dimensional materials.



Dr Aleksandar Matković

*Institute of Physics, Montanuniversität Leoben,
Franz Josef Straße 18, 8700 Leoben, Austria
aleksandar.matkovic@unileoben.ac.at*

2020 Fritz Kohlrusch award

***Needle-like organic
crystals on two
dimensional materials***

Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by COMSOL Multiphysics GmbH; ÖPG Kohlrusch Awards 2020
12:00	12	Needle-like organic crystals on two dimensional materials <i>Aleksandar Matković</i>

2020 Fritz Kohlrausch award

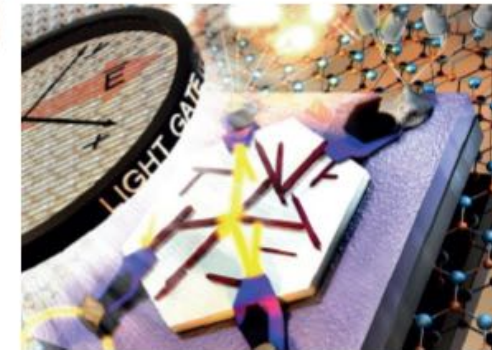
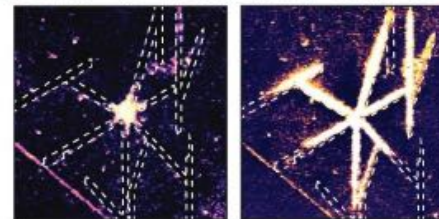
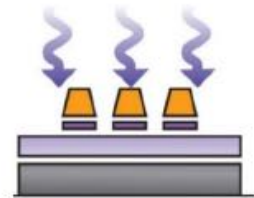
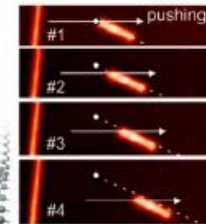
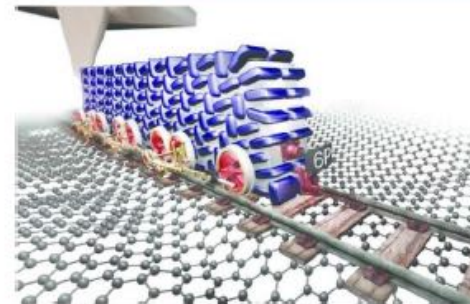
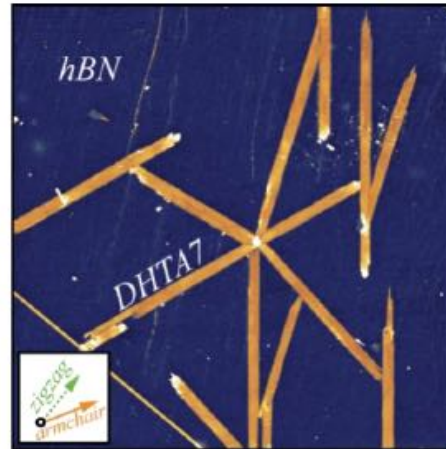
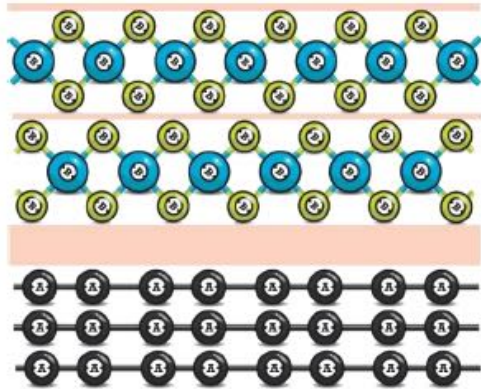
Needle-like organic crystals on two dimensional materials

Van der Waals epitaxy and rotational commensuration

Self-aligned networks of organic nanostructures on 2D materials

Mixed-dimensional vdW heterostructures

Friction anisotropy, unique opportunities in optoelectronics, nanoscale patterning



= no charge propagation

= charge propagation

Ludwig Boltzmann Prize 2021

The Austrian Physical Society awards
the Ludwig Boltzmann Prize 2021 to

Dr. Farokh Mivehvar

for the theoretical achievements in the field of
quantum electrodynamics, quantum magnetism
and light-induced quantum phase transitions
in connection with the physics of ultra-cold atoms.

From Discrete Quasicrystalline to Continuous Lie Symmetries in Cavity QED

Farokh Mivehvar

Institut für Theoretische Physik
Universität Innsbruck

FWF

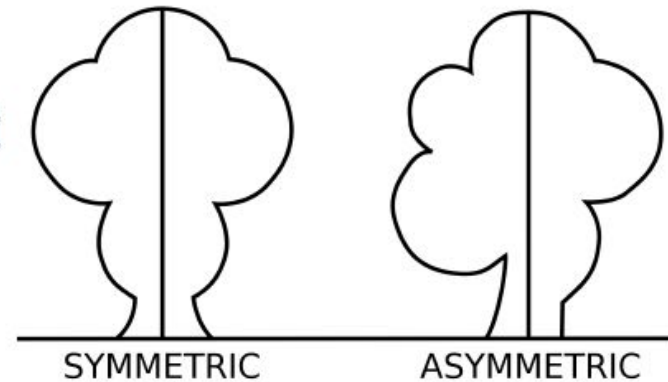
Der Wissenschaftsfonds.



Wednesday, 01.09.2021, Room A

Time	ID	ÖPG Boltzmann Award; Charpak-Ritz Award, sponsored by the SPS and the SFP (Société Française de Physique)
12:00	5	From discrete quasicrystalline to continuous Lie symmetries in cavity QED Farokh Mivehvar

- In a lay language, symmetry refers to the geometric sense of pleasant proportionality and harmony



- Symmetry is ubiquitous in nature
- Discrete vs. continuous symmetries

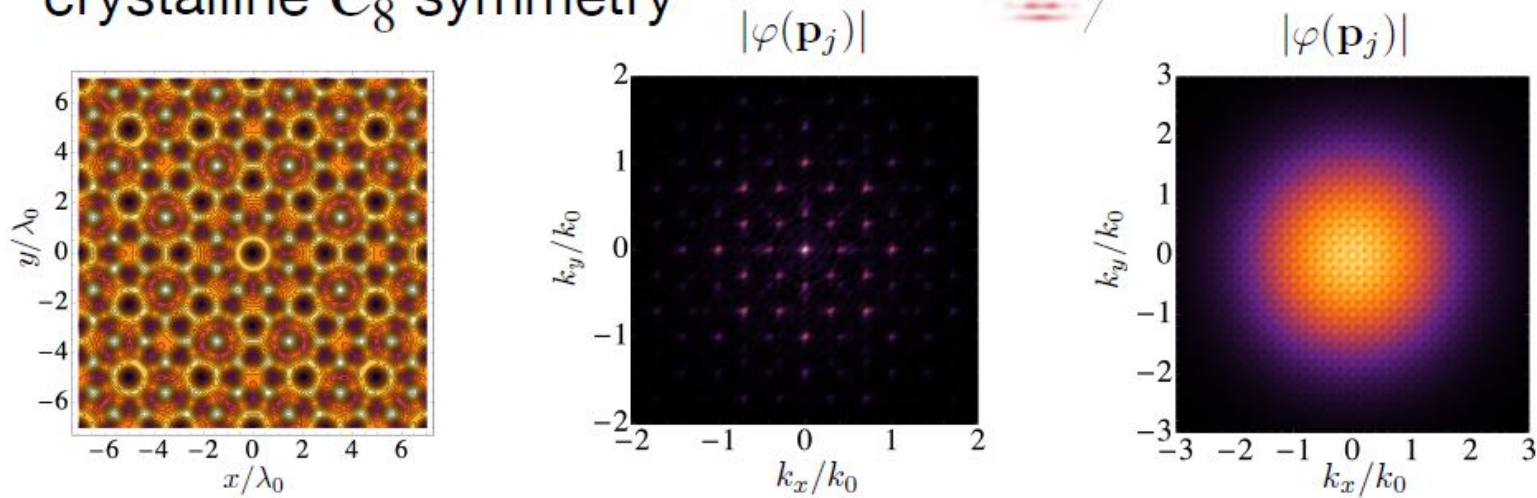
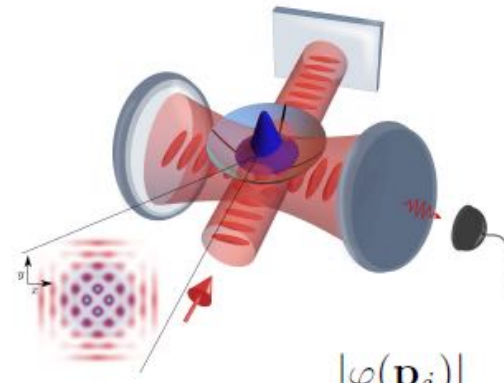


- In quantum physics, symmetry is the invariance of a Hamiltonian under some transformations

$$S^{-1}HS = H$$

“It is only slightly overstating the case to say that physics is the study of symmetry.” P. Anderson

- Cavity QED: quantum gases + quantized electromagnetic fields
- Emergence of discrete quasi-crystalline C_8 symmetry



- Developing the theory of continuous symmetry classification of cavity-QED models: U(1), SU(2), etc.

- Mivehvar, et al., “*Emergent quasicrystalline symmetry in light-induced quantum phase transitions*”, PRL **123**, 210604 (2019)
- Mivehvar, et al., “*Cavity-quantum-electrodynamical toolbox for quantum magnetism*”, PRL **122**, 113603 (2019)



SPG Nachwuchsförderpreis / SSP Prix de la Relève

For the two best performing participants in the Swiss Physics Olympiad

Jugendpreis der SPG / Prix des Jeunes de la SSP

For the two best participants in Schweizer Jugend forscht in the category physics and technology

SPS awards

The SPS awards every year at its annual meeting five prizes of 5'000 CHF each for excellent work of young physicists.

SPS honorary membership

At the request of at least three members of the Society, researchers who have distinguished themselves in the field of pure or applied physics or have rendered outstanding service to the Society may be appointed honorary members by the General Assembly.

Charpak-Ritz Prize

The [French Physical Society](#) and the [Swiss Physical Society](#) have created a joint prize in 2016, the [Charpak-Ritz Prize](#), to highlight the tight relationship between the two societies and to keep the memory alive of Georges Charpak and Walther Ritz who both have profoundly contributed to physics in their respective times.

CHIPP Prize

The CHIPP (Swiss Institute for Particle Physics) Prize is to reward annually the best PhD student in Experimental or Theoretical Particle Physics.



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For the two best performing participants in the Swiss Physics Olympiad

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SPS honorary membership

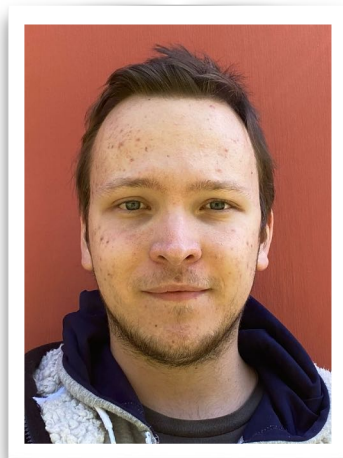
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CHIPP Prize

The CHIPP (Swiss Institute for Particle Physics) Prize is to reward annually the best PhD student in Experimental or Theoretical Particle Physics.



Kylian Gauteron

Lycée-Collège des Creusets (VS)




Valentin Hächler

Gymnasium Oberwil (BL)

Congratulations to
Kylian Gauteron and Valentin Hächler
who are awarded the
SPS Young Talents Prize
(SPS Prix de la Relève, SPG Nachwuchspreis)



Schweizer Jugend Forscht (SJF)


SCHWEIZER JUGEND FORSCHT
SCIENCE ET JEUNESSE
SCIENZA E GIOVENTÙ

Alexis Zuber, 27.10.2001
 Hector Mir, 25.08.2001
 Gymnase du Bugnon, Site de Sévelin

Conception d'une réplique d'un accélérateur de particules

Problématique
 Le but de notre projet est de reproduire, en simplifiant, le fonctionnement d'un accélérateur de particules tel que celui que nous trouvons au CERN. Dans notre projet, des champs magnétiques créés par des bobines de cuivre substituent les champs électriques utilisés dans les « vrais » accélérateurs de particules et des billes ferromagnétiques remplacent les particules.

Méthode
 Dans un premier temps, nous avons fabriqué des bobines de cuivre capable de par leur conception de produire un champ magnétique suffisant pour attirer une bille d'acier. Dans un deuxième temps, afin d'accélérer la bille, nous avons mis en place un moyen de couper le courant lorsque cette dernière se trouve au centre de la bobine.

Résultats
 Les multiples essais et les discussions avec des professionnels nous ont permis de trouver la solution la plus adéquate à notre projet. Le point principal de notre projet a été de trouver un système qui nous permettait de relier, dans un circuit unique, un microcontrôleur n'acceptant pas un courant très élevé alors que la bobine a besoin de bien plus haute intensité de courant pour générer un champ magnétique assez puissant. La connexion de deux sous-circuits grâce à un transistor de type MOSFET nous ont permis d'obtenir des résultats satisfaisants. Le résultat final est constitué de trois bobines placées chacune après un capteur optique. Ce capteur envoie un signal au microcontrôleur qui à l'aide d'un « petit » courant permet l'établissement du « grand » courant et donc la création d'un champ magnétique pendant un temps déterminé auparavant. C'est-à-dire, le montage final de notre projet. Les fils passent sous la planche en bois et rejoignent leur circuit respectif, disposés sur une table à côté (Voir Fig. 4).

Discussion
 Dans l'ensemble, nous sommes satisfaits de nos résultats. Néanmoins, par manque de temps et de moyens, nous n'avons pas atteint tous nos objectifs. Notamment, le fait de pouvoir contrôler la vitesse de notre bille.

Conclusion
 Pour conclure, nous dirions que ce fut un projet et une expérience exceptionnelle. Cependant, le projet n'est pas terminé car, à notre avis, le potentiel d'amélioration de ce projet est énorme et nous restons d'autant plus motivés pour continuer.

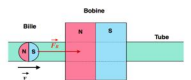


Fig 1 : Schéma de l'attraction par la polarisation de la bille

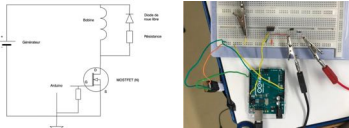


Fig 2 & 3 : Schéma du circuit électrique & Photo du circuit électrique





Fig 4 : Montage de notre projet sur une planche en bois


Physique | Technique

Finalistes: Hector Mir, Alexis Zuber
Expert: Dr. Jorg Wenninger
École: Gymnase du Bugnon, Lausanne
Enseignant: Bernard Furrer
Mention: très bien

Prix spécial Société Suisse de Physique -
Prix des Jeunes de la SSP:



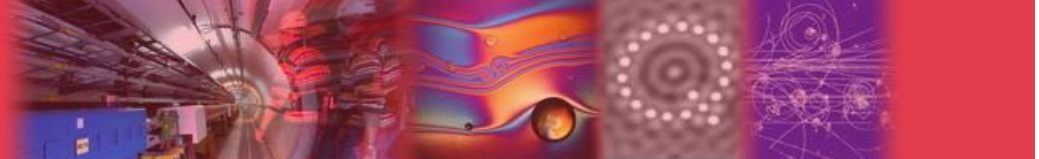
Hector Mir

Gymnase du Bugnon (VD)

Alexis Zuber

Gymnase du Bugnon (VD)

Congratulations to
Hector Mir and Alexis Zuber,
 who are awarded the
Jugendpreis der SPG / Prix des Jeunes da la SSP



SPG Nachwuchsförderpreis / SSP Prix de la Relève

For the two best performing participants in the Swiss Physics Olympiad

Jugendpreis der SPG / Prix des Jeunes de la SSP

For the two best participants in Schweizer Jugend forscht in the category physics and technology

SPS awards

The SPS awards every year at its annual meeting five prizes of 5'000 CHF each for excellent work of young physicists.

SPS honorary membership

At the request of at least three members of the Society, researchers who have distinguished themselves in the field of pure or applied physics or have rendered outstanding service to the Society may be appointed honorary members by the General Assembly.

Charpak-Ritz Prize

The [French Physical Society](#) and the [Swiss Physical Society](#) have created a joint prize in 2016, the [Charpak-Ritz Prize](#), to highlight the tight relationship between the two societies and to keep the memory alive of Georges Charpak and Walther Ritz who both have profoundly contributed to physics in their respective times.

CHIPP Prize

The CHIPP (Swiss Institute for Particle Physics) Prize is to reward annually the best PhD student in Experimental or Theoretical Particle Physics.



The SPS awards every year at its annual meeting five prizes of 5'000 CHF each for excellent work of young physicists.

HITACHI ABB

IBM

oerlikon

 **METAS**

 **COMSOL**



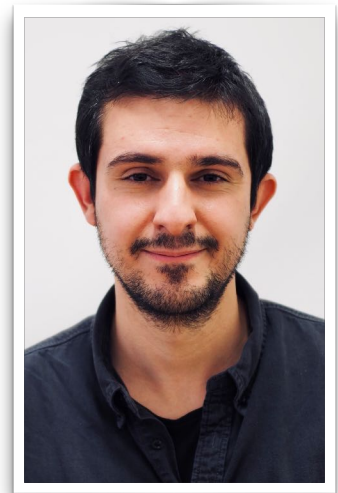
All Physics Domains Prize **HITACHI ABB**

- The **Hitachi ABB Power Grids Prize in all Physics Domains** is awarded to

Dr. Armin Tavakoli

“for his excellent work on Theory of Quantum Information, in particular Quantum Correlations and Communications”

- *PhD in 2020 at the Quantum Information & Communication Group, Uni Geneva with Prof. Dr. N. Brunner*
- Now Institute of Quantum Optics and Quantum Information, IQOQI Vienna



Armin Tavakoli

Wednesday, 01.09.2021, Room F

Time	ID	SPS Award sponsored by Hitachi ABB Powergrids
17:00	521	Informational restrictions in quantum correlations <i>Armin Tavakoli</i>

PhD dissertation: Quantum correlations and communications

Advisors: Nicolas Brunner & Nicolas Gisin

Foundations of quantum theory: *How can we understand quantum theory?*

- Bell nonlocality experiments
- Quantum contextuality
- Links between fundamental concepts
- Rethinking quantum bits of information

Quantum information science: *How can we apply quantum theory?*

- Certification of quantum devices
- Protocols: cryptography and random numbers
- Communication complexity advantages
- Quantum networks
- Quantum thermal machines



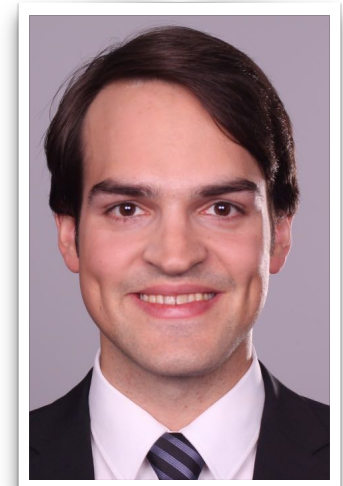
Condensed Matter Prize



- The **IBM Condensed Matter Prize** is awarded to

Dr. Niels Schröter

*“for his excellent work on
Groundbreaking discovery and further investigation of new multifold
fermions in chiral topological semimetals”*



Niels Schröter

- 2018 - 2021 PostDoc at Swiss Light Source (SLS) @ PSI supported by Microsoft
- Now Group leader at Max Planck Institute for Microstructure Physics, Halle, Germany

Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by IBM
14:30	141	New fermions with large topological charges in chiral topological semimetals <i>Niels B. M. Schröter</i>

PAUL SCHERRER INSTITUT



MAX-PLANCK-GESELLSCHAFT

Niels B. M. Schröter

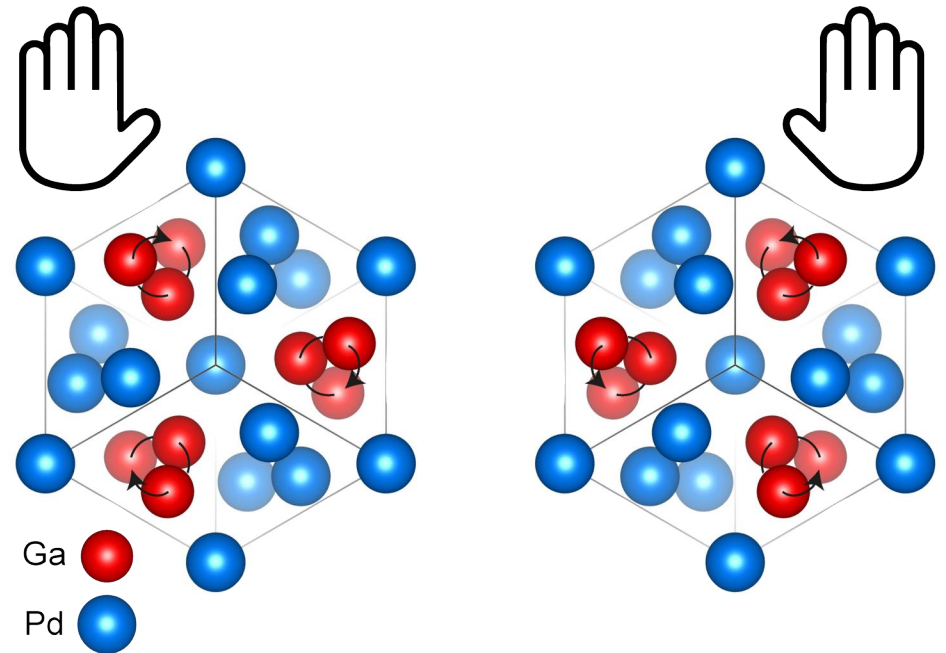
New Fermionic Quasiparticles in Chiral Crystals

Innsbruck, Sept 1st 2021

N.B.M.S. et al.,

Nature Physics **15**, 759–765 (2019)

Science **369**, 179–183 (2020)



What is “new” about these fermions?

Elementary fermionic particles are constrained to occur in only three forms

Electronic quasiparticles can mimic elementary particles and even realize “new fermions” without high-energy analogue



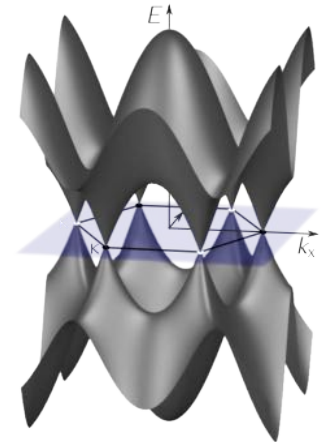
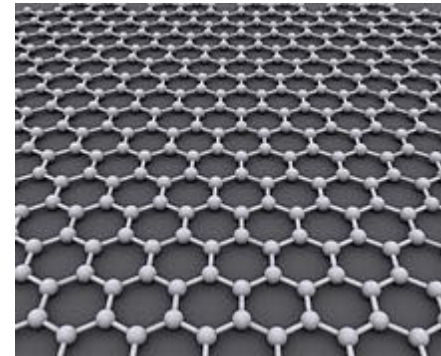
Dirac



Weyl

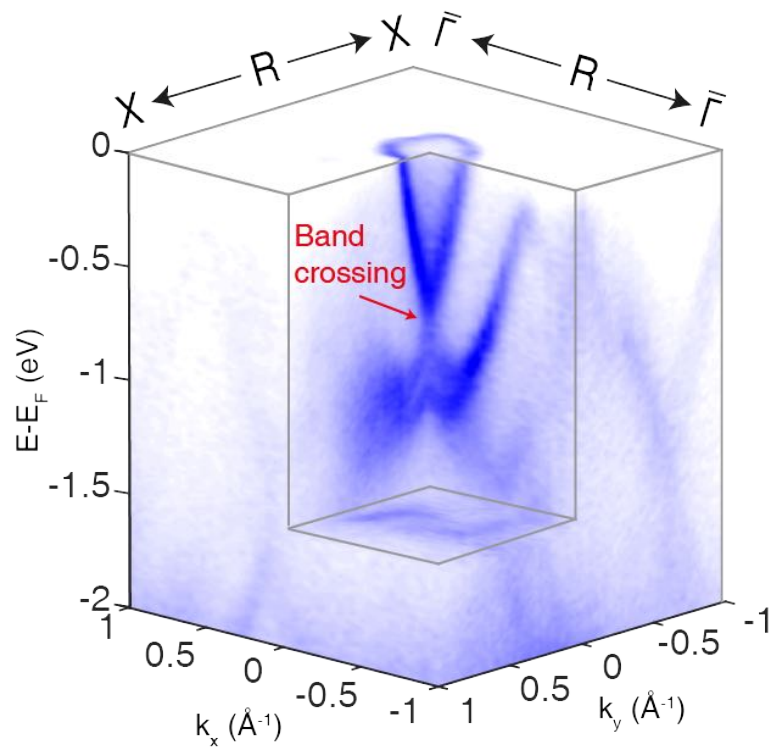


Majorana

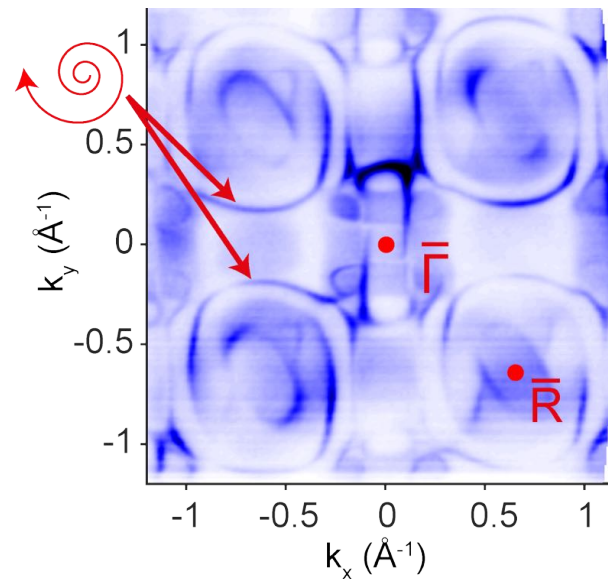


Dirac fermions in graphene

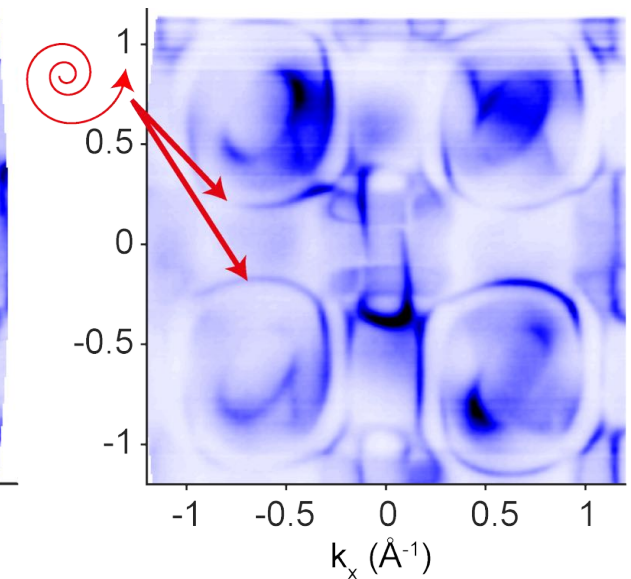
How did we find them? Why are they interesting?



Bulk signatures
of new fermions



Surface signatures of large and
controllable topological charges





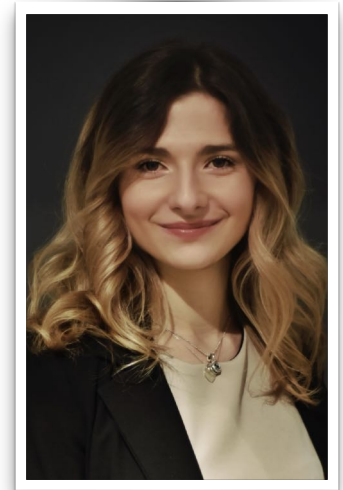
Applied Physics Prize **oerlikon**

- The **Oerlikon Surface Solutions AG Applied Physics Prize** is awarded to

Dr. Clarissa Convertino

“for the Development of an advanced hybrid MOSFET/ tunnel FET platform”

- PhD in 2020 at the Nanolab, EPFL with Prof. M.A. Ionescu and Materials Integration and Nanoscale Devices group (IBM Research –Zurich)
- Now R&D Engineer at Lumiphase Corporation



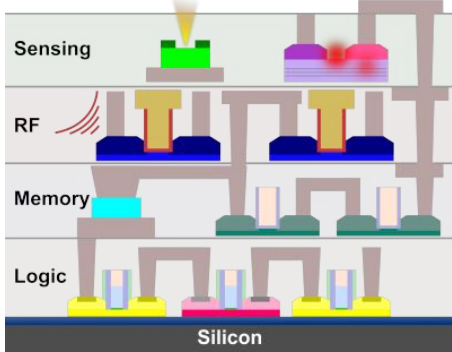
Clarissa Convertino

Thursday, 02.09.2021, Room E

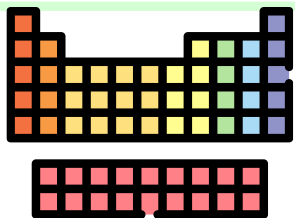
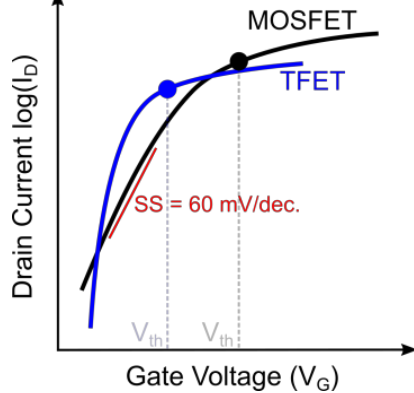
Time	ID	SPS Award sponsored by Oerlikon Surface Solutions AG
17:00	601	Development of an advanced hybrid MOSFET/tunnel FET platform <i>Clarissa Convertino</i>

High-performance III-V MOSFETs and Tunnel-FETs Integrated on Silicon

Heterogeneous 3D Integration



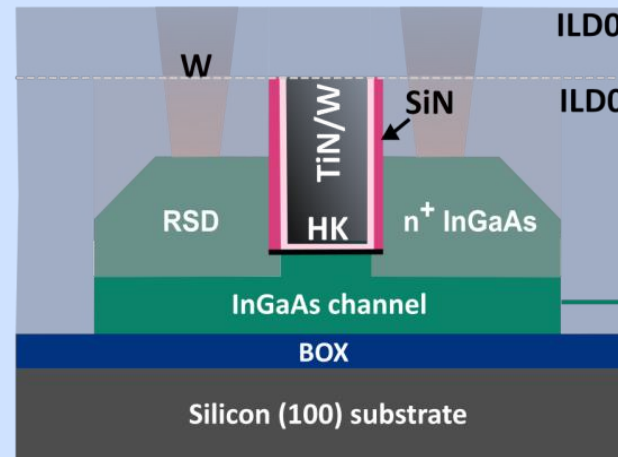
Beyond CMOS devices



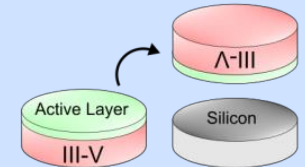
Alternative channel materials (e.g. III-V)



Structure schematic



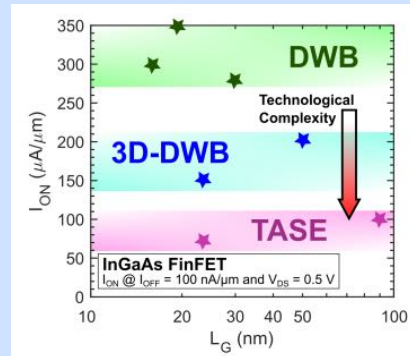
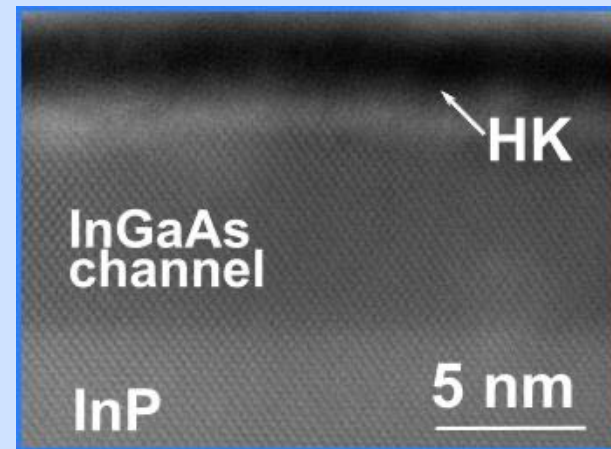
Integration routes



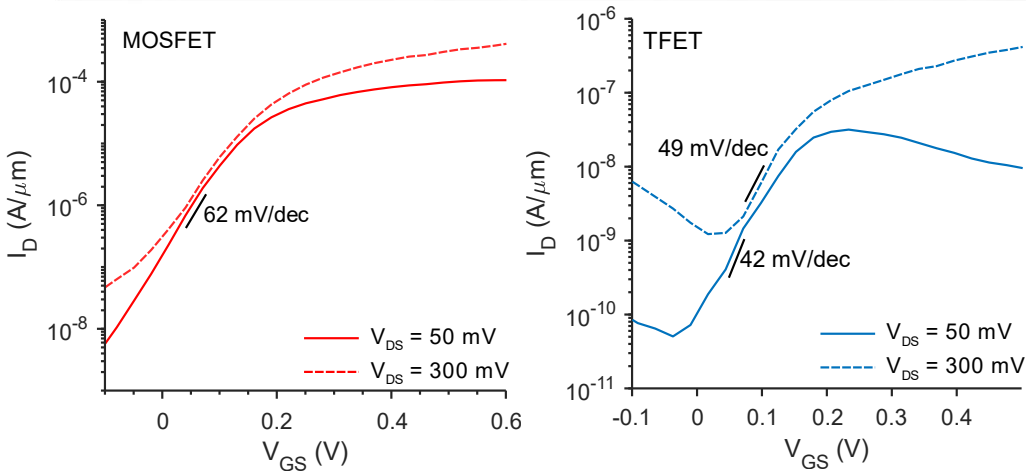
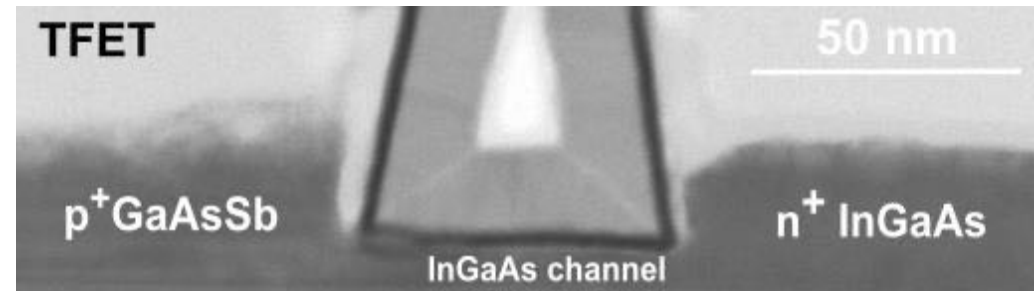
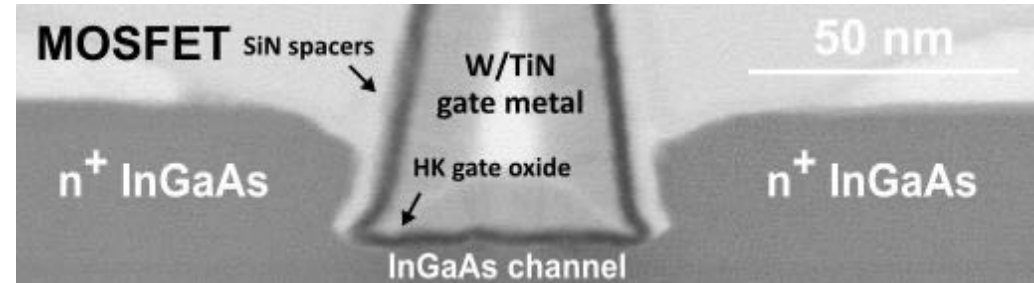
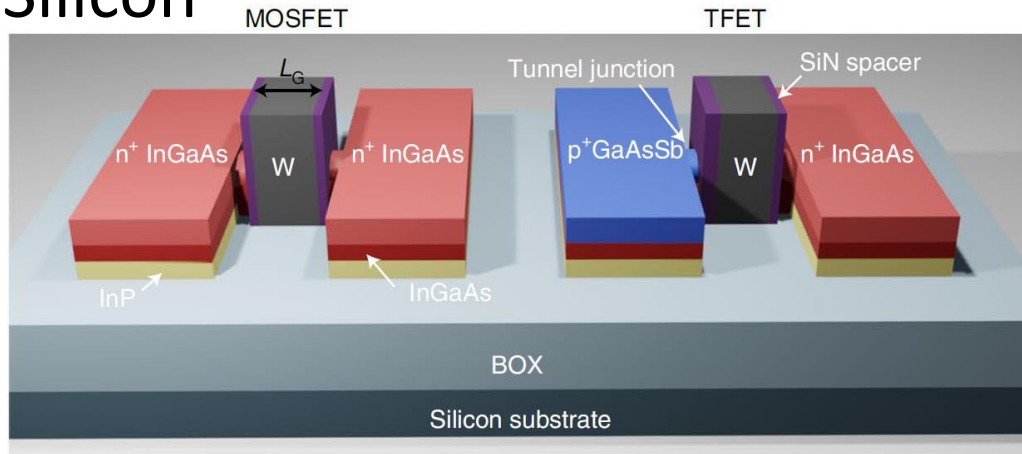
Direct Wafer Bonding



Template-assisted selective Epitaxy



High-performance III-V MOSFETs and Tunnel-FETs Integrated on Silicon



- First demonstration of hybrid co-integration of a III-V MOSFET/TFET
- Record-low SS of 42 mV/dec
- Smallest reported TFET gate length of 25 nm

Now working @ Lumiphase

Dr. Clarissa Convertino, IBM Research – Zurich



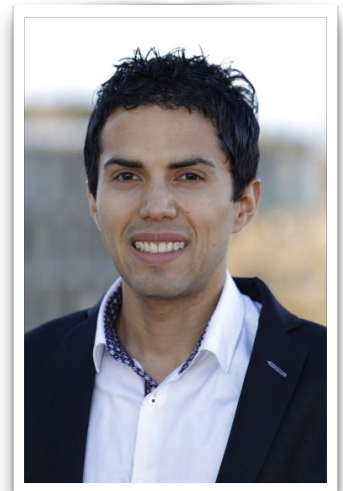
Metrology Prize METAS

- The **METAS Metrology Prize** is awarded to

Dr. Kristian Cujia

*“for his excellent work on
Outstanding research in quantum sensing and quantum metrology with nitrogen vacancies”*

- PhD in 2019 at the Laboratory for Solid State Physics, ETHZ with Prof. Dr. C. Degen (ETHZ)
- Now Postdoc with ITIS Foundation, Zurich, Switzerland

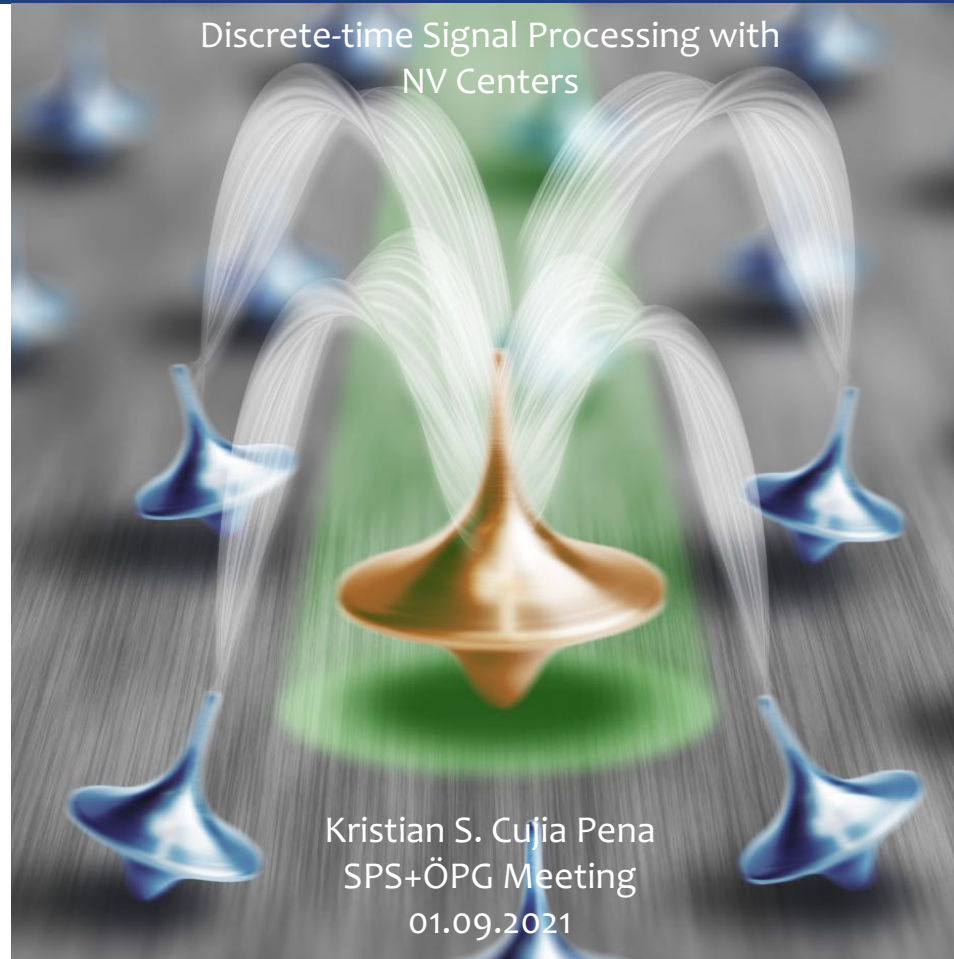


Kristian Cujia

Wednesday, 01.09.2021, Room E

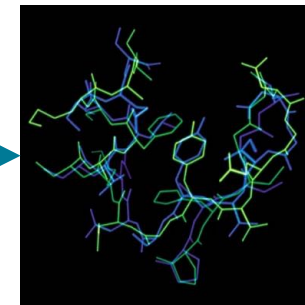
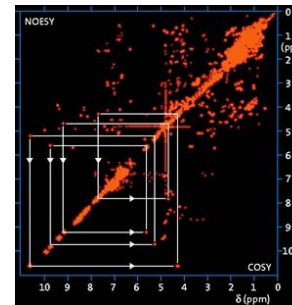
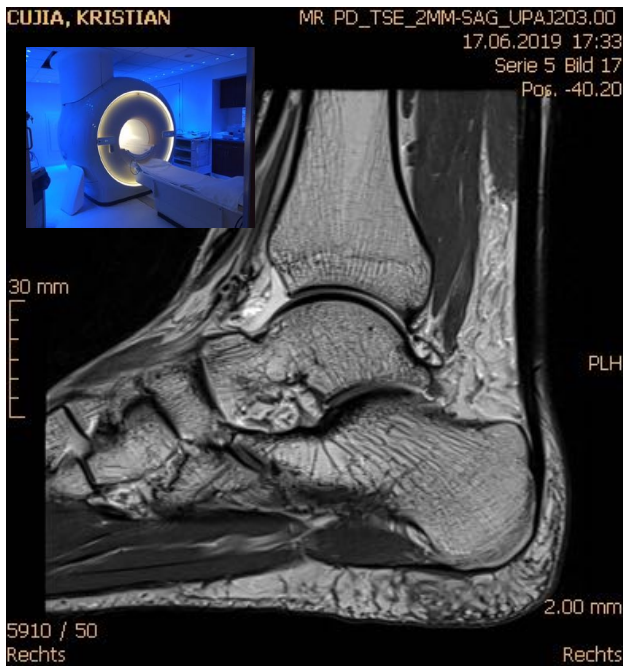
Time	ID	SPS Award sponsored by METAS
14:00	421	Discrete-time signal processing with NV centers <i>Kristian Cujia</i>

Discrete-time Signal Processing with
NV Centers

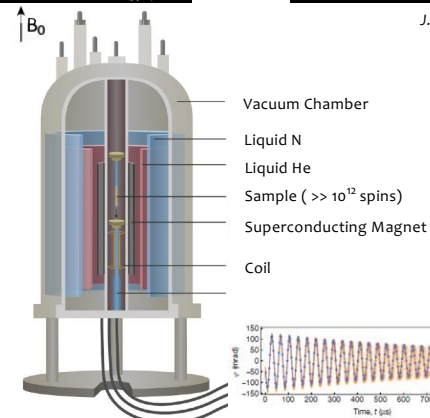


Kristian S. Cujia Pena
SPS+ÖPG Meeting
01.09.2021

Structure Determination

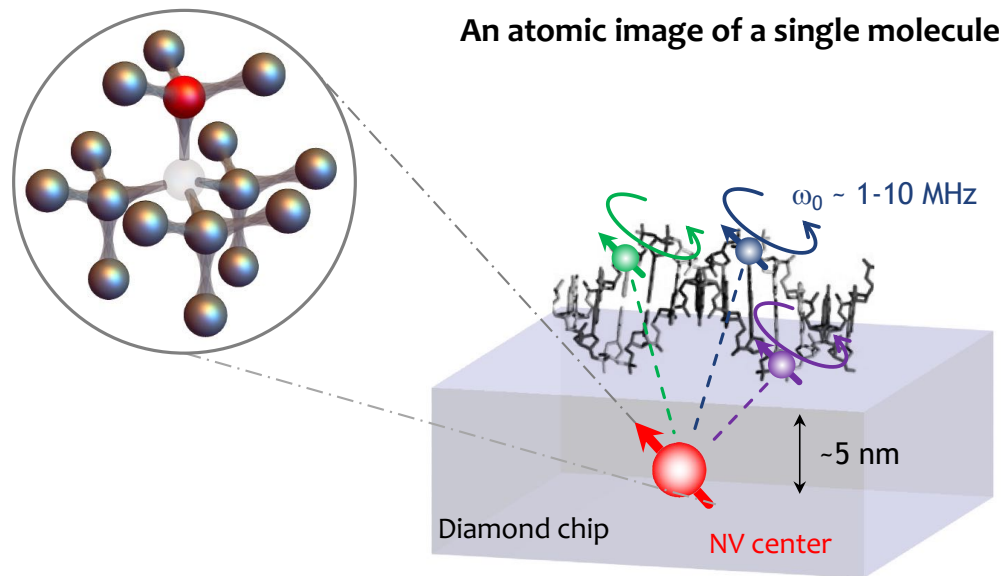


J. Mol. Biol. 182 (1985)



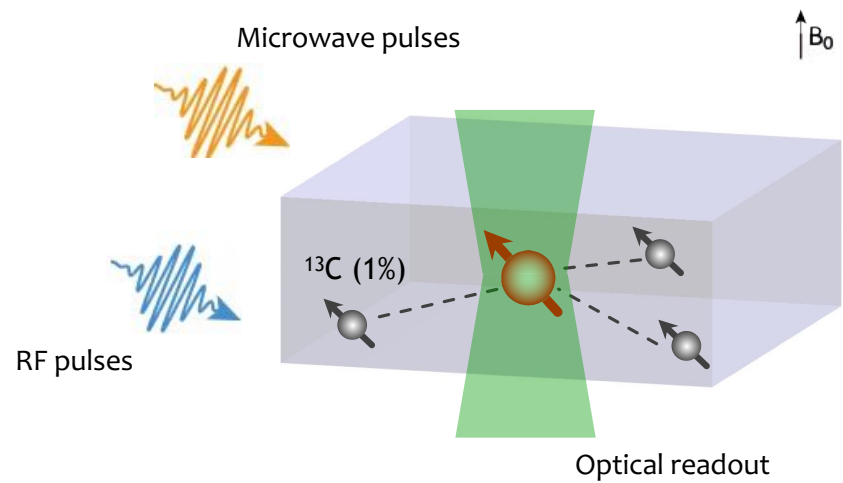
Can we *continuously* detect the FID signal of a single nuclear spin?

Vision (long term)

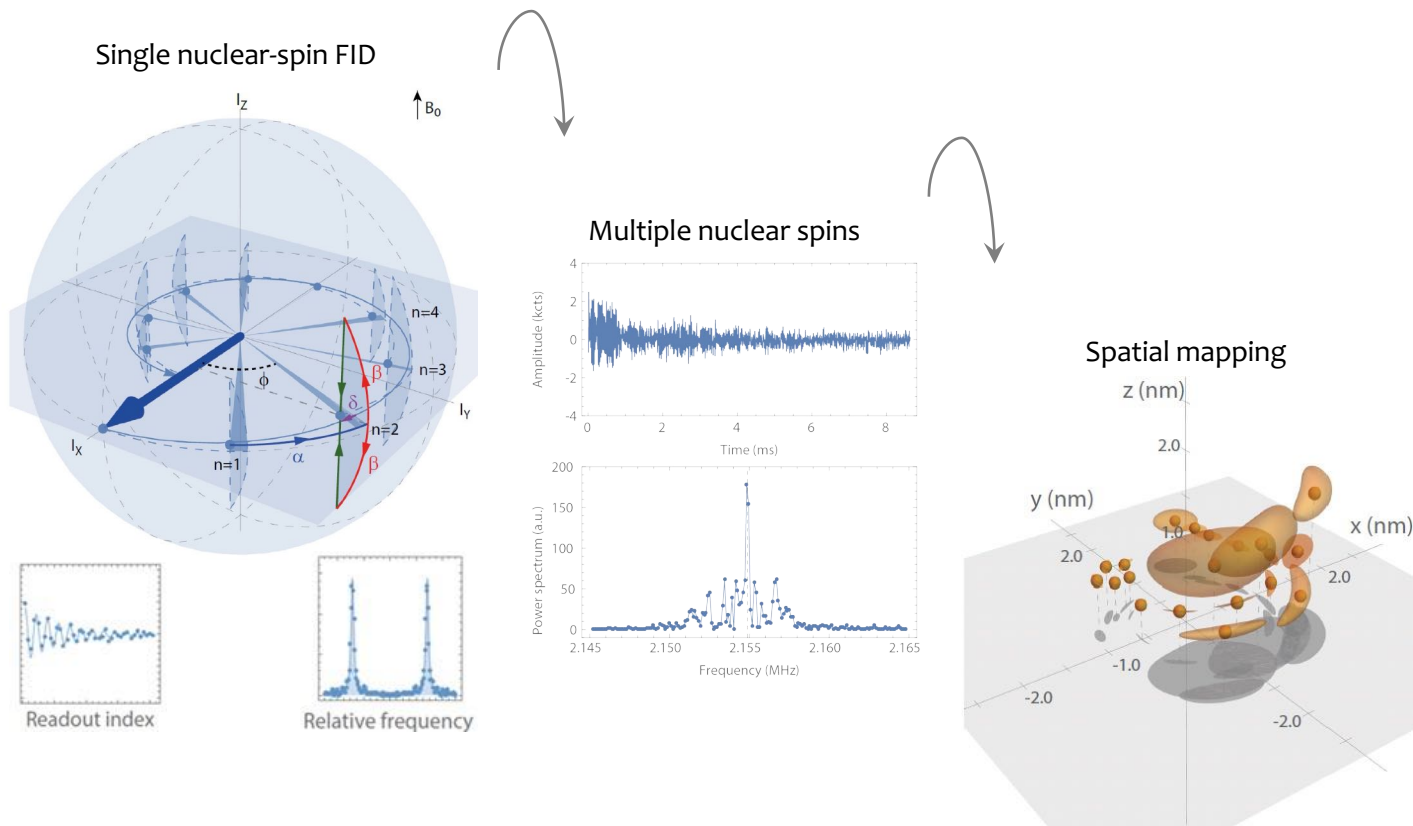


Vision (our scenario)

An atomic image of a single molecule
(first a toy model)



Weak Measurements Spectroscopy



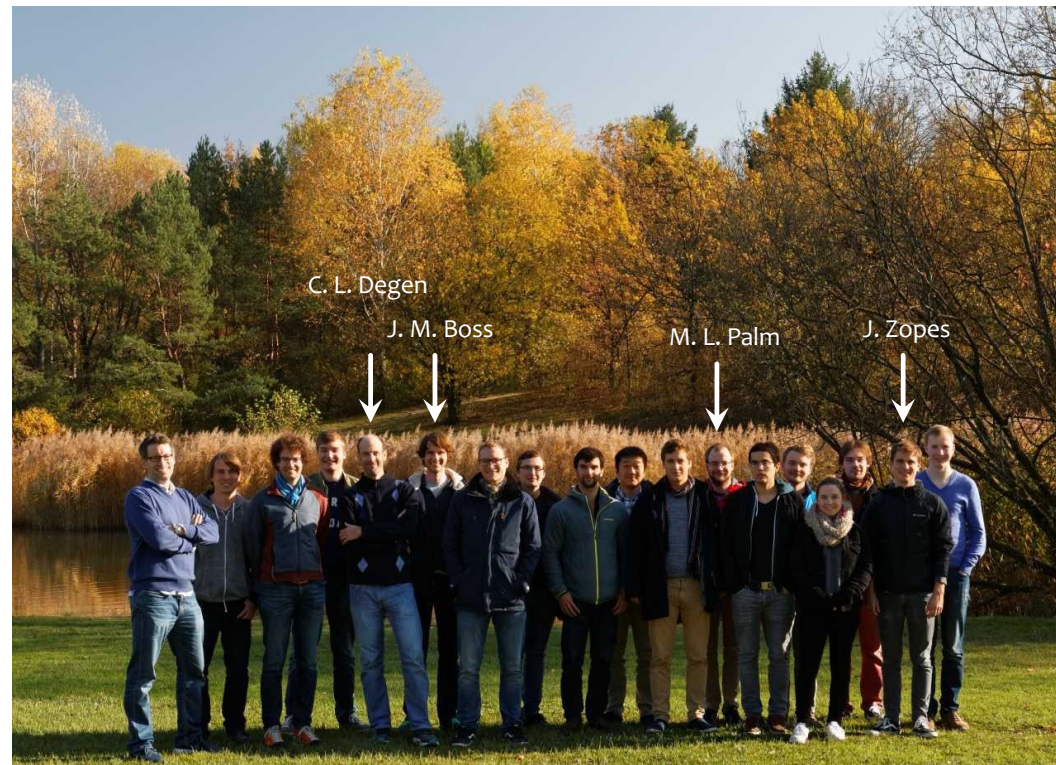
Acknowledgements

Christian L. Degen
Jens M. Boss
Jonathan Zopes
Konstantin G. F. Herb
Marius L. Palm

Yiwen Chu
Andreas Wallraff

Family & Friends

References:
Science 356, 857 (2017)
Nature 571, 230-233 (2019)
arXiv:2103.10669 (2021)





Computational Physics Prize



□ The **COMSOL Computational Physics Prize** is awarded to

Dr. Kenny Jing Hui Choo

*“for his excellent work in
Novel computational approach to solve quantum many-body problems”*



Kenny Choo

□ PhD 2021 in the Condensed Matter Theory group at University of Zurich, with Prof. Dr. Titus Neupert

□ Now post-doctoral researcher with IBM Zürich

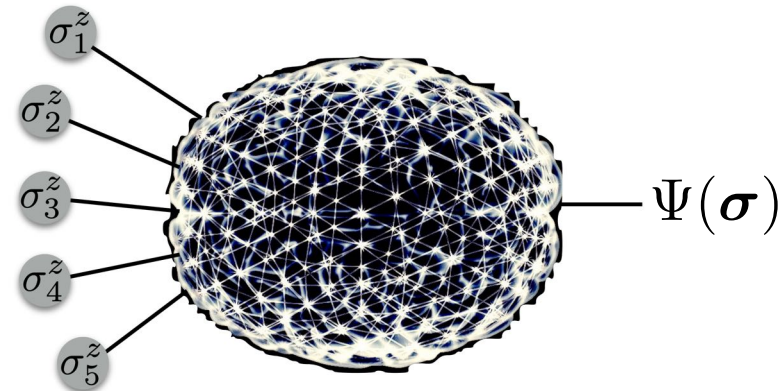
Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by COMSOL Multiphysics GmbH; ÖPG Kohlrusch Awards 2020
11:30	11	Neural Network Quantum States <i>Kenny Choo</i>

Neural Network Quantum States

Neural Networks are maps/functions.

$$\sigma_1 \cdots \sigma_N \rightarrow \Psi(\boldsymbol{\sigma}) \in \mathbb{C}$$



$$\Psi(\sigma_1 \dots \sigma_N) = g^L \circ W^{(L)} \dots g^{(1)} \circ W^{(1)} \boldsymbol{\sigma}$$

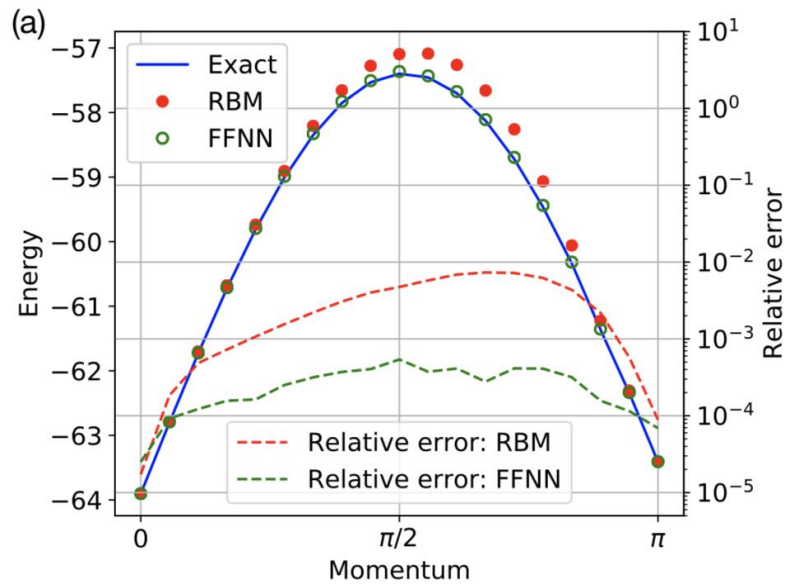
Non-Linear Activation
(Applied Component-Wise)
e.g Tanh

Linear/Affine Transformation
(Complex Parameters)

$$W^{(1)} \boldsymbol{\sigma} = \begin{bmatrix} W_{11} & \cdots & W_{1N} \\ W_{21} & \cdots & W_{2N} \end{bmatrix} \begin{bmatrix} \sigma_1 \\ \vdots \\ \sigma_N \end{bmatrix}$$

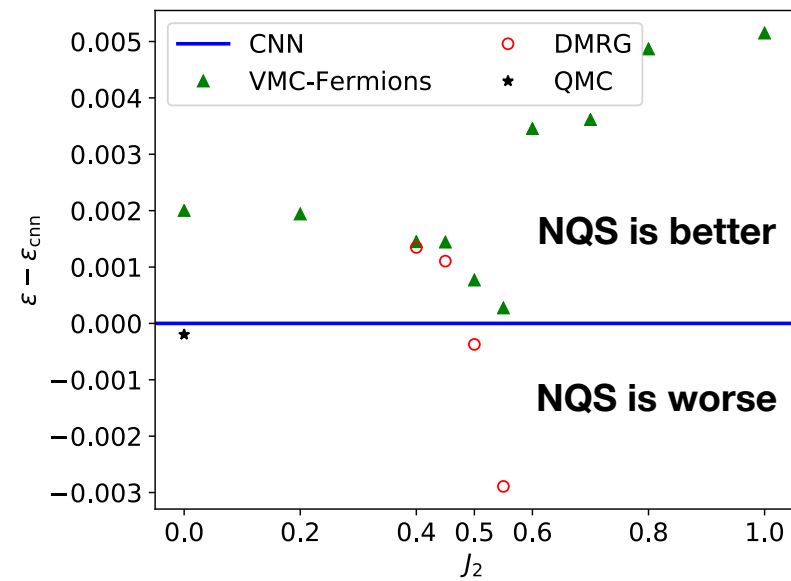
Highlights

Momentum Spectrum of 1D Heisenberg Model

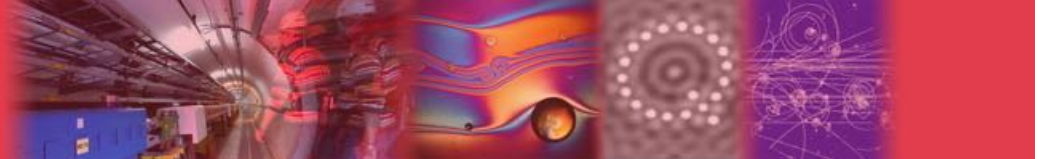


KC, Carleo, Regnault, Neupert,
PRL 121, 167203 (2018)

Benchmark on J1-J2 Model on Square Lattice



KC, Neupert and Carleo
PRB 100, 125124 (2019)



SPG Nachwuchsförderpreis / SSP Prix de la Relève

For the two best performing participants in the Swiss Physics Olympiad

Jugendpreis der SPG / Prix des Jeunes de la SSP

For the two best participants in Schweizer Jugend forscht in the category physics and technology

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CHIPP Prize

The CHIPP (Swiss Institute for Particle Physics) Prize is to reward annually the best PhD student in Experimental or Theoretical Particle Physics.



PROF. DR. BERND KRUSCHE, UNIVERSITÄT BASEL
PROF. EM. DR. MARTIN C.E. HUBER, ETH ZÜRICH
PROF. EM. DR. NORBERT STRAUMANN, UNIVERSITÄT ZÜRICH

Basel, Küssnacht and Oberrohrdorf,
20 April 2021
4056 Basel, Klingelbergstrasse 82
e-mail: bernd.krusche@unibas.ch

Prof. Dr. Hans Peter Beck
President of the Swiss Physical Society

Nomination of Prof. em. Dr. Karl-Friedrich Thielemann for honorary SPG membership

Dear Hans Peter, dear Colleagues

We take great pleasure in nominating Prof. em. Dr. Karl-Friedrich Thielemann for honorary membership of the Swiss Physical Society to acknowledge his extensive scientific oeuvre in astrophysics and nuclear physics, as well as his service in many scientific advisory bodies, among them the Research Council of the Swiss National Science Foundation (SNF).

After initial schooling and a Matura at the Martin-Butzer Gymnasium in Dierdorf (Germany), Friedel Thielemann – as he is known among his colleagues – studied at the Technische Hochschule (now the Technical University) in Darmstadt and got his Diploma in Physics in 1976 and a PhD in 1980. He then pursued an extended international career with stations at the Enrico Fermi Institute in Chicago, the California Institute of Technology, the Max-Planck-Institute for Nuclear Physics in Heidelberg, the MPI for Astrophysics in Garching near Munich, the University of Illinois at Urbana-Champaign, and the Department of Astronomy at Harvard University. In 1994 he settled as Professor of Theoretical Physics at Basel University. After his retirement in Basel, he remains an active scientist as permanent guest in the Theory Group at the GSI Helmholtz Center for Heavy Ion Research near Darmstadt.

His research centres around the question of 'how the Universe has been made'. He approached this question by doing much basic work on how the chemical elements we find in today's Universe have been produced in all kinds of stellar and other environments. This required a deep understanding both of galactic evolution and of the nuclear physics governing the reactions contributing to thermonuclear element production.

The database REAFLIB, maintained by the Joint Institute for Nuclear Astrophysics – nowadays the basis for nucleosynthesis applications – largely benefits from his work on thermonuclear reaction rates that he pursued for decades with several of his students. Friedel was and is also very active in the community addressing the theoretical and experimental issues of nuclei far from stability, which are very important to understand element production rates via the fast neutron capture reaction (*r*-process). At many international laboratories experimental programs are now underway to investigate such nuclei with radioactive beams.

Prof. Thielemann also studied in detail the properties of various astrophysical objects – supernovae, white dwarfs, and neutron stars, for example – where such reactions occur. This required input from many different fields, such as gravitational aspects, hydrodynamics

of matter, reaction rates for neutrinos etc. which he all combined in his research. The scope of his work thus ranges from the fundamentals of nuclear and particle physics over the properties of all kinds of stellar objects, and results in a broad view of galactic evolution.

In all these fields his publications are benchmark papers with several hundreds of citations; as examples we mention his work with Nomoto and Yokoi on White Dwarfs and his work with Rauscher on Astrophysical Reaction Rates from statistical models. His most recent review paper about the origin of the heaviest elements from neutron *r*-process reactions will certainly have significant impact on the field. Contrary to what most people were thinking, there is now new evidence that not supernovae, but more likely other environments like, for example, neutron-star mergers are prime sources for the heavy elements, such as gold.

The supreme quality of Karl-Friedrich Thielemann's scientific work is reflected by the prestigious prizes that have been awarded to him. Before his PhD already he was awarded the Otto Hahn Medal for Junior Scientists by the Max Planck Society and – to mention just a few of the most prestigious later ones – he received the Hans A. Bethe Prize of the American Physical Society (2008), the Lise Meitner Prize of the European Physical Society (2012), and very recently (2020) the Karl Schwarzschild Medal of the 'Astronomische Gesellschaft'.

He has inspired generations of young scientists with his ideas and by offering an excellent environment in his research group. Many of his former students and post-docs are now themselves very successful and productive researchers and carry on his work at different Universities and research laboratories. He also conveyed his enthusiasm for physics and astrophysics in his lecture courses and – well beyond the University – to an even larger audience through his fascinating talks in the Basel 'Saturday-Morning' Physics programme.

Last but not least, Friedel participated in different bodies to promote Nuclear Physics and Astrophysics, both in Switzerland and worldwide. At Basel University he served as Department Chairman, Member of the Regenz and Vice Dean of the Science Faculty. He was member of the SNF Research Council, President of the Platform MAP of the Swiss Academy of Science, Associate Editor for *Nuclear Physics A* and *Reviews of Modern Physics*. He also served on the Board of Directors of the Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT) in Trento and contributed to many advisory committees of international laboratories.

In view of his outstanding scientific accomplishments and grateful for his many voluntary supporting activities, we propose Prof. Karl-Friedrich Thielemann

for his comprehensive oeuvre elucidating the origin of the elements, which is based on studies of nuclear reaction rates and a deep understanding of the evolution of various astrophysical objects, such as, for example, supernovae, white dwarfs, and neutron stars, and for his indefatigable support of young researchers and his colleagues, as well as for his extensive work in scientific advisory bodies

for honorary membership of the Swiss Physical Society.

With best regards



Bernd Krusche

Martin Huber

Norbert Straumann

Art. 5

Sur la présentation de trois membres de la Société au moins, le titre de membre honoraire peut être décerné par l'assemblée générale, soit à des chercheurs qui se sont distingués dans le domaine de la physique pure ou appliquée, soit à des personnes ayant rendu d'excellents services à la Société. Les membres honoraires ne payent pas de cotisation.



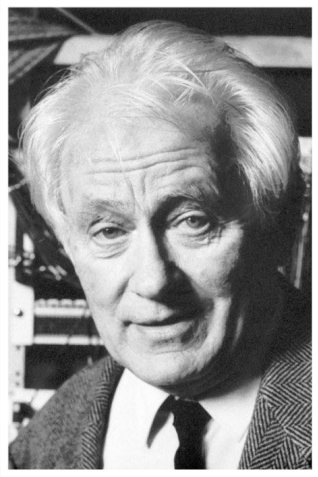
The Swiss Physical Society awards **honorary membership** to

Prof. Friedrich-Karl Thielemann

for his comprehensive oeuvre elucidating the origin of the elements, which is based on studies of nuclear reaction rates and a deep understanding of the evolution of various astrophysical objects, such as, for example, supernovae, white dwarfs, and neutron stars, and for his indefatigable support of young researchers and his colleagues, as well as for his extensive work in scientific advisory bodies.



Friedrich-Karl Wilhelm Thielemann



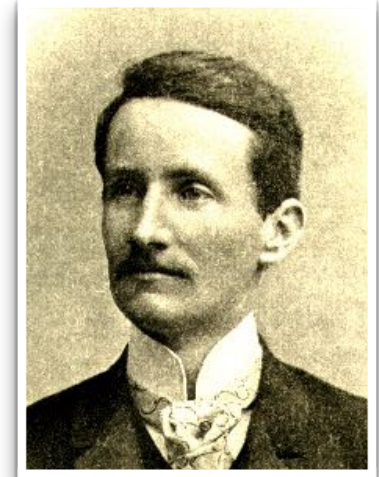
Georges Charpak

*1 August 1924, Dabrovica, Poland

†29 September 2010, Paris, France

Nobel Prize 1992

"for his invention and development of particle detectors, in particular the multiwire proportional chamber."



Walther Ritz

*22 February 1878, Sion, Switzerland

†7 July 1909, Göttingen, Germany

Ritz lunar crater named after Walther Ritz

Rydberg-Ritz Formula

Ritz method to find an approximate solution for boundary value problems.

The significance of the prize is twofold: on the one hand it is intended to show every year the deep connection between the two founder societies, the [Société Française de Physique](#) (SFP) and the Swiss Physical Society (SPS), on the other hand it is intended to honour a colleague whose contributions to Physics are considered as of epochal character. In odd years like 2019 a person is elected by the Swiss Physical Society out of three candidates that have been short-listed and nominated by the French Physical Society, in even years this relation is inverted.

The Charpak-Ritz Prize 2021 is awarded to

Dr. Marie-Emmanuelle Couprie

Researcher at the 2.75 GeV electron synchrotron SOLEIL, located south of Paris, for her outstanding contributions in

“... light sources using particle accelerators to emit synchrotron radiation of high spectral purity and high degrees of longitudinal and transverse coherence, in particular her research programme in recent years moved towards compact and free electron lasers (FEL). As a major actor in a very competitive research field, Marie-Emmanuelle Couprie achieved outstanding results relevant for the physics and technology of accelerators at the core of the synchrotron light emitted by FELs. The jury appreciated also the excellent and very fruitful collaborations at the international level and with the Swiss community at Paul Scherrer Institute in Villigen / Switzerland for magnetic measurements.”

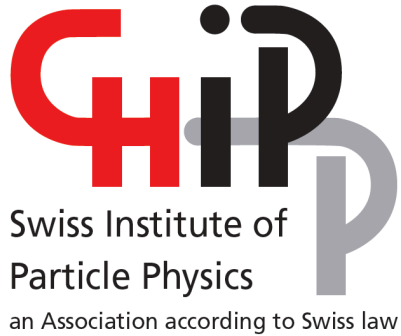


Marie-Emmanuelle Couprie

Wednesday, 01.09.2021, Room A

La Société Française de Physique et la Société Suisse de Physique félicitent Marie-Emmanuelle Couprie.

Time	ID	
		ÖPG Boltzmann Award; Charpak-Ritz Award, sponsored by the SPS and the SFP (Société Française de Physique)
12:30	6	An adventure along Free Electron Laser development Marie-Emmanuelle Couprie



CHIPP, the Swiss Institute of Particle Physics, is an association uniting researchers active in particle, astroparticle and nuclear physics in Switzerland. The objectives of CHIPP are to coordinate and strengthen the Swiss participation in international projects and committees, coordinate research and teaching activities in Switzerland, and promote public awareness of the field.

CHIPP Prize

The CHIPP (Swiss Institute for Particle Physics) Prize is to reward annually the best PhD student in Experimental or Theoretical Particle Physics.

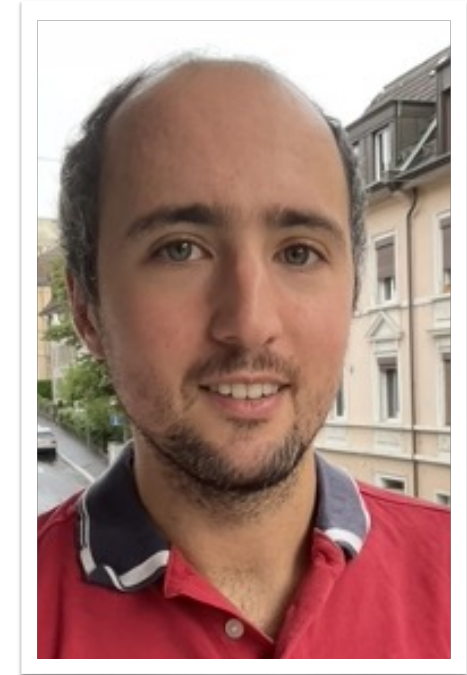
CHIPP Prize

Swiss Institute of
Particle Physics
an Association according to Swiss law

- The **CHIPP Prize** jury honours

Dr. Gabriel Cuomo

“for his outstanding theoretical studies of quantum field theories in the strongly coupled regime, which elucidated new properties relevant to a variety of physical systems: from condensed matter to cosmology.”

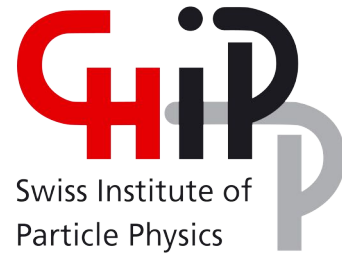


Gabriel Cuomo

- PhD 2020 at EPFL with Prof. R. Rattazzi
- Now: Postdoctoral researcher at the Simons Center for Geometry and Physics, Stony Brook University, NY, USA

Wednesday, 01.09.2021, Room B

Time	ID	CHIPP Award; ÖPG Viktor-Franz Hess Awards 2021 + 2020
14:00	321	Large charge, semiclassics and superfluids <i>Gabriel Cuomo</i>



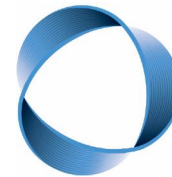
Large charge, semiclassicals and superfluids:
from broken symmetries to conformal field theories

Gabriel Cuomo

Chipp prize award ceremony – 1 September 2021



Stony Brook **University**



SIMONSCENTER
FOR GEOMETRY AND PHYSICS

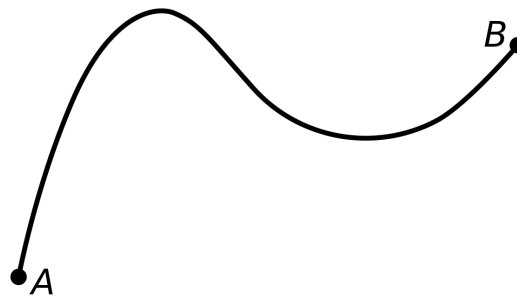
Classical vs quantum

- Classical physics: unique trajectory from initial state

$$S[q] \implies \frac{\delta S[q]}{\delta q} = 0 \implies q = q_{\text{classical}}(t)$$

- Quantum physics: average over all possible trajectories

$$\mathcal{A}[A \rightarrow B] \simeq \sum_{\text{paths}} e^{iS[q_p]} \implies \text{Prob}[A \rightarrow B] = |\mathcal{A}[A \rightarrow B]|^2$$



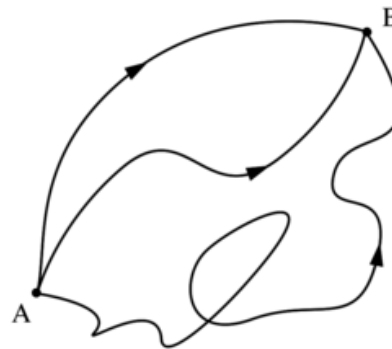
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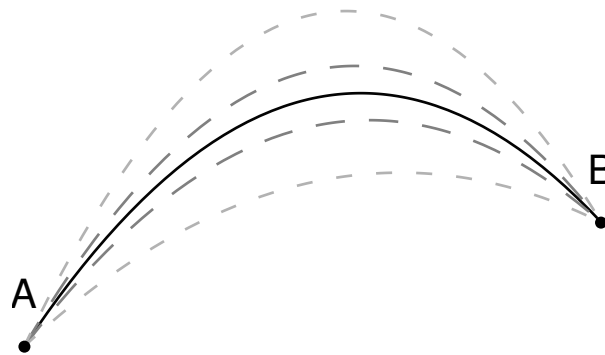
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Semiclassics

Summing over all possible paths may be very hard... but we do not always need to do that.

- *Semiclassical* observables can be computed expanding around their value on the classical trajectory:



$$\langle \mathcal{O}[q] \rangle = \underbrace{\mathcal{O}(q_{class.})}_{\text{classical value}} + \underbrace{\delta_q \mathcal{O}}_{\text{calculable quantum correction}} .$$

My thesis in nutshell

The aim of my thesis was to develop novel semiclassical techniques to study otherwise intractable physical systems.

My results include:

- identification of *universal* properties of large density phases (\sim superfluids) which are found e.g. in ferromagnets and QCD.
- development of a new semiclassical approach to study certain observables with *apparently* large quantum fluctuations in systems at criticality.

Joint Annual Meeting in Innsbruck, 30 August - 3 September 2021

Award Talks

Wednesday, 01.09.2021, Room A

Time	ID	ÖPG Boltzmann Award; Charpak-Ritz Award, sponsored by the SPS and the SFP (Société Française de Physique)
12:00	5	From discrete quasicrystalline to continuous Lie symmetries in cavity QED <i>Farokh Mivehvar</i>
12:30	6	An adventure along Free Electron Laser development <i>Marie-Emmanuelle Couprie</i>

Wednesday, 01.09.2021, Room B

Time	ID	CHIPP Award; ÖPG Viktor-Franz Hess Awards 2021 + 2020
14:00	321	Large charge, semiclassics and superfluids <i>Gabriel Cuomo</i>
14:30	322	Glueballs and Gauge / Gravity Duality <i>Frederic Brünner</i>
14:50	323	Measurement of the prompt χ_{e1} and χ_{e2} polarizations at CMS <i>Thomas Madlener</i>

Wednesday, 01.09.2021, Room E

Time	ID	SPS Award sponsored by METAS
14:00	421	Discrete-time signal processing with NV centers <i>Kristian Cujia</i>

Wednesday, 01.09.2021, Room F

Time	ID	SPS Award sponsored by Hitachi ABB Powergrids
17:00	521	Informational restrictions in quantum correlations <i>Armin Tavakoli</i>

Wednesday, 01.09.2021, Room G

Time	ID	ÖPG Sexl Award
14:00	801	Naturwissenschaftliche Bildung für unsere gemeinsame Zukunft im Licht des aktuellen MINT-Hypes – eine fachdidaktische Perspektive <i>Ilse Bartosch</i>

Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by COMSOL Multiphysics GmbH; ÖPG Kohlrusch Awards 2020
11:30	11	Neural Network Quantum States <i>Kenny Choo</i>
12:00	12	Needle-like organic crystals on two dimensional materials <i>Aleksandar Matković</i>
12:15	13	^{233}U / ^{236}U signature allows to distinguish thermal reactor emissions from weapons fallout in the environment <i>Karin Hain</i>

Thursday, 02.09.2021, Room A

Time	ID	SPS Award sponsored by IBM
14:30	141	New fermions with large topological charges in chiral topological semimetals <i>Niels B. M. Schröter</i>

Thursday, 02.09.2021, Room E

Time	ID	SPS Award sponsored by Oerlikon Surface Solutions AG
17:00	601	Development of an advanced hybrid MOSFET/tunnel FET platform <i>Clarissa Convertino</i>



Joint Annual Meeting of the
AUSTRIAN PHYSICAL SOCIETY
SWISS PHYSICAL SOCIETY

CONGRATULATIONS AGAIN TO ALL THE LAUREATES

Thank you for all your wonderful works and achievements and all the best with your next steps in academia, industry and wherever innovation is key and where good insights and persistency when solving whatever task you will be up to, are deeply required !