



Newsletter #4

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Foreword

This is the Newsletter n.4 of the STRONG-2020 European project, which has been prepared by the Dissemination Board as Editors, and contains a series of news and information of interest not only for the STRONG-2020 Community, but also for a broader scientific community and the general public.

The Newsletter n.4 is structured as follows: the first article is written by the Management Team (Barbara Erazmus, Emine Ametshaeva and Carlo Guaraldo) and regards the STRONG-2020 Annual Meeting (2021 edition): an opportunity to meet and clarify new perspectives. This first article is followed by news concerning some ongoing STRONG-2020 activities, in particular tools developed within the 3DPartons work package, for extraction of the proton internal pressure distribution, and the first kaonic atoms from SIDDHARTA-2 experiment on DAΦNE at the INFN-LNF, supported by Transnational Access (WP5). Short reports on various workshops and schools are following, including the International School on Muon Dipole Moments and Hadronic Effects – in memoriam Simon Eidelman, the online joint meeting on QCD, the WE-Heraeus-Seminar Light Dark Matter searches, the NA7 workshop and the 16th International Workshop on Meson Physics – MESON 2021. An article regarding the latest very successful STRONG-2020 Public Lectures organized within the project is included, together with an interview to the ECT* Director Gert Aarts, realized by Maria Paola Lombardo and Piet Mulders. The Newsletter closes with Obituaries, in the memory of dear colleagues, key-figures in the community of strong interactions studies, recently passed away.

We, the STRONG-2020 Dissemination Board, encourage you, the community participating to this project to contact us and send us news regarding your achievements (published articles, experimental developments, theoretical calculations), your events organized within or with support of STRONG-2020, videos about your activities, interviews to young and less young participants and any other information or news relevant for our community and/or to a broader scientific community and to general public which is connected to our project.

We are looking forward to meet you at the STRONG-2020 Annual Meeting to be held on November 8 and 9, 2021, in Nantes, France.

Catalina Curceanu, on behalf of STRONG-2020 Dissemination Board

Marco Battaglieri, Maurizio Boscardin, Achim Denig, Raphaël Granier de Cassagnac, Maria Paola Lombardo, Hervé Moutarde, Piet Mulders, Andrea Pesce, Fulvio Tassarotto.

STRONG-2020 Annual Meeting (2021 edition): an opportunity to meet and clarify new perspectives

Barbara Erazmus (CNRS/IN2P3, Subatech Laboratory, France), Carlo Guaraldo (LNF-INFN, Italy) and Emine Ametshaeva (CNRS/IN2P3, Subatech Laboratory, France)

The 2021 edition of the STRONG-2020 Annual Meeting will take place on November 8 and 9, in Nantes, France. We will be delighted to meet with you all, face-to-face or remotely, to discuss the progress made during the past year and exchange about the prospects for the future.

The past year, marked by the sanitary crisis, was complicated and unprecedented for a research project like ours. Indeed, by promoting networking and joint research activities, STRONG-2020 puts at its core the exchange and cooperation of the scientific community in the field of nuclear and particle physics. We therefore had to deal with the new context of limitations and restrictions, where virtual meetings and workshops replaced the real ones. However, the impact of pandemic on transnational access activities turned out in a general reduction of beam-hours that could be delivered by the infrastructures. We would like to thank all of you for your dedication, participation and contribution to the life of this community that makes up our project.

As traditionally, this Annual meeting will become the opportunity to analyze the work carried out during the year. The WP leaders will have the possibility to present their achievements and progress but also to share their problems, and eventually to propose changes to initial work plans. The two days of plenary meetings will be fully dedicated to these presentations and discussions amongst all the members of the Consortium. This in turn will allow an objective assessment of the overall progress of the project, its compliance with the obligations of the Grant Agreement and future perspective of its development.

On the first day of the meeting, we will present the actual status of the project, with the most significant events that have taken place since the last Annual meeting. In addition to the First Amendment acceptance and the Periodic Report approval, two events that all the Consortium members have been informed about, there were also some important structural changes on the EU Commission level. The European Commission has established six new executive agencies that will assist in the implementation of new Horizon Europe projects, as well as provide the support in the running Horizon 2020 projects. Thus, the administration of already existing Horizon 2020 projects was transferred to the newly formed agencies.

As a result of this structural reorganization, starting April 2021, the management of the STRONG-2020 project at the EU level is implemented by the REA agency. A new Project Officer (PO) was assigned to the project. Simona Misiti, as a new PO, supervised our project from April to September 2021. She was also responsible for the verification and evaluation of our First Periodic Report. Simona Misiti was then replaced, in September 2021, by another

PO, Flavius Pana. His presentation is expected on the first day of the Annual meeting. This series of structural changes slowed down the assessment of our Periodic Report and significantly lengthened the review period for the Second Amendment.

As for the latter, the project's Second Amendment was launched during summer (August 13, 2021) and the modifications requested within it are still under consideration. This Amendment is of special importance for the project: we request the project extension by 6 months. The decision about the necessity of this extension was already made during the last year's Annual meeting where most of the WP leaders have expressed their concern about the impossibility of meeting some deadlines because of the Covid-19 restrictions. After a series of discussions between the Management team and new POs, it was finally decided to stick with the 6 months extension option, easier to obtain from an administrative procedural point of view. Other modifications we intend to introduce with the present Amendment, as well as the details of its progress, will be presented during the Annual meeting.

Governing Board and Executive Board meetings have become indispensable parts of our Annual meetings. This year's edition is not an exception. Since last year, we have also asked the leaders of Transnational and Virtual Access to get together in the frame of Facility Coordination Panel meeting. The schedule for these restricted meetings, as well as the overall Agenda of the Annual meeting, can be found on the dedicated indico page:

<https://indico.in2p3.fr/event/25163/>

You will also find there the details for accommodation, the explanations of how to get to the meeting place using public transport and the venue plan. The links for ZOOM connection for remote participants, for plenary as well as restricted sessions, will be also given on the event page. After the meeting, the page will be supplemented with the WP's presentations and minutes of the meetings.

We would really love to see you all in person, after this long break. However, we are aware of the travel difficulties in terms of potential risks that some of you may encounter and we understand that preserving the health of our Consortium members is paramount. For this reason, this year's edition will be hybrid and we strive to ensure the optimal conditions for the participants in place and those who will participate remotely.

Whatever the mode of your participation is, we are looking forward to your active participation.

With our best regards,

Barbara, Carlo and Emine

Can we measure the proton internal pressure?

Herve Dutrieux (IRFU, CEA, Université Paris-Saclay, France), Cedric Lorcé (CPHT, CNRS, Ecole Polytechnique, France), Herve Moutarde (CEA, IRFU, France), Pawel Sznajder (NCBJ, Poland), Arkadiusz Trawiński (CEA, IRFU, Ecole Polytechnique, CPHT, France), Jakub Wagner (NCBJ, Poland).

Generalized parton distributions (GPDs) provide essential information about the 3D structure of the proton. Remarkably, they are related to the QCD energy-momentum tensor and provide access to the mechanical properties of the proton like the distribution of pressure induced by its quark and gluon structure. GPDs can be constrained through several exclusive processes (all particles are detected in the final state), and in particular deeply virtual Compton scattering (DVCS). In principle, the pressure distribution can be experimentally determined in a model-independent way from a dispersive analysis of DVCS data through the measurement of the subtraction constant. In practice, this endeavor is a challenge because of the kinematic coverage and accuracy of existing experimental data.

Using tools developed within the 3DPartons work package of STRONG-2020 and elaborating on recent global fits of DVCS measurements using artificial neural networks, a team of European physicists summarized the current knowledge on this subtraction constant [1]. In this field of research, most of the effort has been dedicated so far to the determination of two proton fundamental characteristics, denoted d_1^q or d_1^g , which respectively relate to the magnitude of pressure forces exerted by the quarks of flavor q or by gluons. These quantities depend on a factorization scale μ_F which governs the separation between short and large distances in hard exclusive processes like DVCS. The dependence on this scale can be computed perturbatively in QCD. Fig. 1 compares the extraction of Ref. [1] to the other existing phenomenological or theoretical estimations.

The DVCS data alone do not permit yet a statistically significant extraction of the proton internal pressure distribution. This study establishes the need for more precise data and for an extension of the covered kinematic domain. It paves the way for future works when more precise data become available, *e.g.* with the foreseen electron-ion colliders EIC and EicC.

The 3DPartons [2] work package aims at releasing the open-source codes necessary for high precision phenomenology in the field of 3D hadron structure. It allows the accurate extraction of various parton distributions from experimental data and the computation of derived quantities like spin, pressure or femto tomography. This work package integrates and maintains flexible and up-to-date codes. It aggregates computational knowledge and know-how about 3D hadron structure and keep them available to the hadron structure community on a long-term.

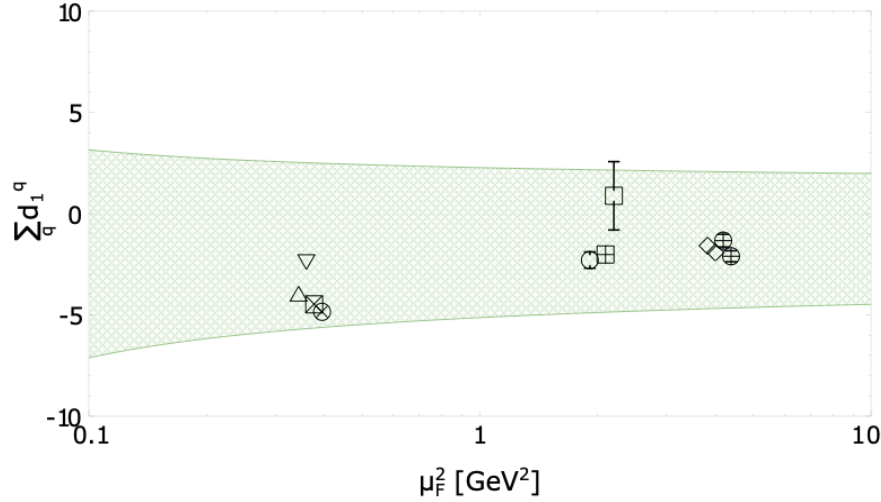


Fig. 1: The sum over quark flavors q of $d_1^q(\mu_F)$ as a function of μ_F for this study (green band) and other phenomenological and theoretical analyses. See Tab. 2 of Ref. [1] for the description of each data point, including the marker legend. Figure from Ref. [1].

References

- [1] H. Dutrieux et al. “Phenomenological assessment of proton mechanical properties from deeply virtual Compton scattering”, Eur. Phys. J. C81 (2021) 300
- [2] <http://partons.cea.fr>

First kaonic atoms from SIDDHARTA-2 experiment on DAΦNE

Catalina Curceanu (LNF-INFN, Italy)

On July 19, the first data taking of the SIDDHARTA-2 experiment at the DAΦNE collider at INFN-LNF (Italy) was successfully concluded. The experiment receives support within the STRONG-2020 project within the Transnational Access (WP5).

SIDDHARTA-2 is an international collaboration, among 12 institutions from 7 countries, aiming at studying strong interaction measuring the X-rays emitted in the transitions from different energy levels of kaonic-atoms. A kaonic atom is formed when one of the orbital electrons is replaced by a negative charge kaon produced by the DAΦNE collider. The experiment uses forefront technologies, in particular new silicon spectroscopic detectors (Silicon Drift Detectors) to detect X-rays and a complex veto system to cut down the background.

The first SIDDHARTA-2 run has been performed with SIDDHARTINO, a subset version of SIDDHARTA-2, intended to measure the first kaonic-atoms during the tuning of the DAΦNE accelerator.

After the lockdown that stopped the activity of the accelerator for about 10 months, DAΦNE was re-started in February 2021 with the goal to provide beams of kaons to SIDDHARTINO minimizing the background of X-rays coming out from spurious hits.

The DAΦNE accelerator complex is intended to realize collisions between electron and positron beams extremely focused and with high intensities that result in the production of an intense flux of low energy kaons. Kaons with these characteristics are practically unique in the world and are ideal to study strong interaction at threshold.

During these months, the parameters of the colliding beams have been suitably tuned and, starting from May 2021, SIDDHARTINO began the data taking with a maximum luminosity of about $8 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$, a deliberately moderate value to favour a progressive understanding of the new apparatus. This phase was also fundamental to understand the most effective parameters to reduce the background which, at the end of this working period, was more than halved.



Part of the SIDDHARTA-2 Collaboration (April 2019)

In this context, SIDDHARTINO measured X-rays corresponding to transitions to the 2p level of kaonic-Helium4 with different configurations of the detector and two different densities of Helium. These studies will help in getting a better understanding of the atomic cascade, and in the study of the kaonic-Helium itself for which is expected a precision on the measurement of the energy of the X-rays compatible with the best measurements done up-to-now.

During summer, the SIDDHARTA-2 collaboration installed on DAΦNE the full apparatus to be ready for the measurement of the kaonic-deuterium that will start in Autumn 2021 and will be continued through 2022 also with support from STRONG-2020.

International School on Muon Dipole Moments and Hadronic Effects – in memoriam Simon Eidelman

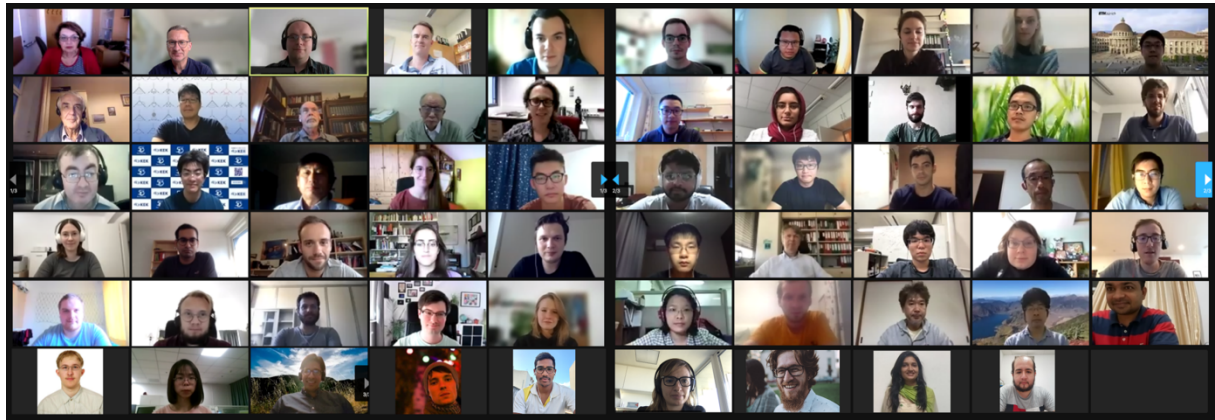
Achim Denig (PRISMA⁺ Cluster of Excellence and Johannes Gutenberg University Mainz, Germany)

Earlier this year, the Muon g-2 collaboration at Fermilab released its long-awaited measurement of the anomalous magnetic moment of the muon, which shows a strengthening of the discrepancy between the direct measurement and the prediction within the Standard Model (in total 4.2 standard deviations). Given this exciting situation, there was a great interest in the 2nd edition of the “International School on Muon Dipole Moments and Hadronic Effects”, which was held online from 30th of August to 2nd of September, with more than 70 active participants from all over the world. The topic as well as related aspects were discussed during eight lectures given by invited experts: Klaus Blaum (Heidelberg), Svjetlana Fajfer (Ljubljana), Bastian Kubis (Bonn), Ivan Logashenko (Novosibirsk), Marina Marinkovic (Zurich), Daisuke Nomura (KEK), Christoph Redmer (Mainz), Graziano Venanzoni (Pisa).

The concept of this school, which was organized by Achim Denig (Mainz), Simon Eidelman (Novosibirsk), Tsutomu Mibe (KEK), and Boris Shwartz (Novosibirsk), was to bring together young researchers involved in the global effort of investigating this large excess, either by directly measuring the anomalous magnetic moment or by predicting this value theoretically. The schedule was adapted to enable participation ranging from Chicago to Tokyo, but still allowing ample time for questions and longer discussions, both in the lecture room as well as in the dedicated virtual event platform. The participating students were offered a set of selected preparatory exercises. Among the replies, three winners were given a copy of the book "The Anomalous Magnetic Moment of the Muon" by Friedrich Jegerlehner.

This was the second edition of this school, which was originally planned to take place in the middle of the historical center of Mainz but had to be postponed and shifted to an online format due to the COVID-19 pandemic. The first edition took place in 2018 at the Budker Institute of Nuclear Physics in Novosibirsk, Russia. This school was initiated by our dear

colleague and co-organizer Simon Eidelman, who sadly passed away at the beginning of this summer, and who was honored by his friends and colleagues throughout this school.



October 2021

Joint workshop on QCD

Cynthia Hadjidakis (IJCLab, CNRS/IN2P3 and Université Paris-Saclay, France), Laure Massacrier (IJCLab, CNRS/IN2P3 and Université Paris-Saclay, France) and Hervé Moutarde (CEA, France)

The groups “Fixed target experiments at LHC”, “NLOAccess” and “3DPartons” of STRONG-2020, and “QCD at short distances: experiment, theory and tools” of the GDR QCD, organized an [online joint meeting between May 31 and June 4, 2021](#).



The *Groupement De Recherche Chromodynamique Quantique* (GDR QCD) is a structure which federates theorists and experimentalists from French laboratories who share a common interest: the study of the strong interaction. This joint workshop was the opportunity to gather

participants of various work packages of STRONG-2020, and extend the audience to the French QCD community.

Fixed target experiments at LHC

The members of the Joint Research Activity « Fixed target experiments at LHC » (FTE@LHC) had their second workshop since the start of the STRONG-2020 project in 2019. The FTE@LHC group aims at developing novel techniques to carry out the most energetic fixed-target collisions ever performed in the laboratory using LHC beams at ALICE and LHCb. The group is motivated by physics questions related to quark and gluon distributions in the nucleon and nuclei at high momentum fraction, including the charm content of the proton and its connexion with astroparticle physics, the quark and gluon Sivers effects and the proton spin, and the quark-gluon plasma.

In the joint sessions of the workshop, the results of the SMOG gaseous target of LHCb were presented, highlighting the unique results obtained with the LHC beams used in a fixed target mode. The proposed implementations of the fixed target experiments at the LHC, as well as their challenges, were reviewed. The status and progresses of these implementations (ALICE fixed target, SMOG2, LHCSpin and SELDOM) were further discussed during three devoted sessions on hardware, simulations and physics and phenomenology. In the physics and simulations session, physics prospects were presented: heavy-flavor, antiproton and superheavy particle production in ALICE, cold nuclear matter study with hadron production in pA in LHCb, and Λ_{c} production and polarisation in LHCb. In addition, the prospects for Drell-Yan production were discussed, as well as the progress towards the charm baryon dipole moment measurement with a double bent crystal setup.

NLOAccess

During this workshop, a joint session between the GDR activities and the Virtual Access NLOAccess took place. The GDR working group « QCD at short distances » organized its kick-off meeting during this joint workshop. The goal of this working group is the investigation of QCD at short distances including its phenomenology at proton and heavy-ion colliders. Its activities include specific calculational aspects and tools used in perturbative QCD without any restriction concerning the studied observables. The perimeter includes the calculation of radiative corrections at fixed order or to all orders in resummation, the automation of calculations, the techniques to interface event generators as well as the definition of new observables. The working group also aims at offering new collaboration opportunities between theorists working with perturbative QCD and LHC/EIC experimentalists.

Talks introducing several Monte Carlo generators of common interest were given and followed by a hands-on session which gathered about 20 researchers and students (from master one to PhD). A second session of the workshop was dedicated to high-level review

talks covering, on the theory side, the state of the art on computations of electro-weak and QCD corrections for LHC processes, and recent developments on resummation for collider physics. On the experimental side, relevant QCD results from heavy quarks at RHIC and LHC as well as high p_T experimental results on top, W, Z and Higgs at the LHC were covered. The talks were followed by a round table discussion on the research goals to be achieved in the French community during the lifetime of the GDR. Finally, a last session of the workshop was devoted to state-of-the-art talks on Monte Carlo generators followed by a round table discussion on the Monte Carlo tools developments in France.

3DPartons

The main objective of the Virtual Access 3DPartons is to give access to open-source code necessary for high precision phenomenology in the field of 3D hadron structure, with a specific emphasis on generalized parton distributions (GPDs) and transverse momentum dependent parton distributions (TMDs). This work package offers users a long-term guarantee about robust, flexible, validated and up-to-date code. It integrates, maintains, releases, tests, documents and provides technical assistance to users.

Two sessions took place during the workshop. The first one was dedicated to generalized parton distributions (GPDs). Publicly available codes were described with a specific focus on GPD evolution codes. A round table discussion delivered plans to benchmark such codes, similarly to the effort made for parton distribution functions (PDFs) in the past. As an example of a physics output which can be obtained by elaborating on the various interoperable tools delivered within 3DPartons, a talk described the prospects of measurements of deeply virtual Compton scattering (DVCS) off a pion target on the future electron-ion colliders EIC and EIC. Such data would yield an experimental knowledge of the 3D structure of the pion.

The second session was broadly dedicated to computing codes for nucleon structure at large, covering PDFs, GPDs or transverse momentum dependent (TMD) PDFs. All kinds of codes were covered, from event generators to statistical data analysis. A round table discussion about how lattice QCD calculations could help improving PDF or GPD fits closed this second session.

Light Dark Matter Searches -- 21th WE-Heraeus-Seminar

Patrick Achenback (PRISMA⁺ Cluster of Excellence and Johannes Gutenberg University Mainz, Germany), Luca Doria (PRISMA⁺ Cluster of Excellence and Johannes Gutenberg University Mainz, Germany), Marco Battaglieri (Thomas Jefferson National Accelerator Facility and Istituto Nazionale di Fisica Nucleare)

From the 8th to the 11th of June 2021 the WE-Heraeus-Seminar was held online to discuss light dark matter searches with national and international experts from experiments as well as from theory. The topic of this workshop is related to one of the biggest unanswered questions in physics: What is dark matter? Many observations suggest that the universe is filled with as yet



unknown elementary particles that have in total about five times the mass of all ordinary matter. The long-standing search for such particles is focused at masses significantly above the proton mass and has up to now been unsuccessful. Consequently, there has been an intensified search for lighter particles that could be part of a dark sector of particle physics. Just as there are both matter particles and mediator particles of various forces in the Standard Model of particle physics, so far undiscovered particles in the dark sector interact with each other through new forces. The mass scale of light dark sector particles such as mediators and stable particles could be comparable to the proton mass or below.

Light dark matter would be very difficult to detect with high-energy colliders or with direct detection experiments using established techniques, so accelerator-based dark matter searches with smaller, but dedicated experiments are becoming more important. In the seminar, many different ideas and methods of experimental verification were discussed, also because possible particles of a dark sector are energetically accessible at a number of accelerators worldwide. The research field includes, for example, measurements at the accelerator facilities MAMI in Mainz/Germany, DAΦNE in Frascati/Italy, Thomas Jefferson Lab in Virginia/US, J-PARC in Tokai/Japan, searches at the electron-positron experiments Belle-II at KEK/Japan, BaBar at SLAC/US, BESIII in Beijing/China and, last but not least, several ongoing and future projects at CERN. Some proposals are yet to be implemented, including those at the future accelerator MESA in Mainz. The capabilities of high-intensity electron and proton beams enable unique opportunities for probing the dark sector. These accelerator-based approaches are complemented by new technological developments to detect the predicted

cloud of dark matter particles in our Milky Way by collisions with sensitive detectors in underground laboratories such as Gran Sasso, deep beneath the Apennine Mountains of Italy. These experimental approaches are mostly complementary to searches for dark matter at the high-energy frontier at CERN.

One focus of the seminar was devoted to dark photons, the hypothetical counterparts of the quanta of the known electromagnetic interaction. However, this dark radiation is only one possible portal through which dark sector particles could interact with the Standard Model. While most experiments provide exclusion limits for regions in mass and coupling strength, experimental evidence for a particle called X17 has been very controversial.

Although this was a virtual seminar, the online platform emulated a real scientific conference as closely as possible. It allowed not only for plenary sessions but also for poster sessions, and particularly encouraged personal interactions during the seminar. The numerous posters were produced with high quality by the young scientists and could be presented conveniently on the MeetAnyway platform. Because of the online format that became necessary and the widely separated time zones of the 22 invited speakers, the seminar had to be concentrated into a core time in the afternoon.

WILHELM UND ELSE
HERAEUS-STIFTUNG



The NA7 workshop

Joerg Aichelin (Subatech, France)

The first of the planned workshops of NA7 took place in Hersonissos/Crete on October 4-8. Some colleagues, due to corona, hesitated still to attend a conference. Finally, 34 people followed our invitation.



The purpose of this network was:

- a) to bring together the younger people, graduate students and postdocs, who work in the 20 participating theory laboratories which are part of the network and presenting them a forum to present their work.

- b) to give lectures on topics which require experts who are not available in the laboratories from which the researchers originate. This time, 2 long lectures on "Schwinger-Dyson approach" and "Lattice gauge calculations" and shorter lectures about transport approaches, quarkonia and neutron stars have been scheduled.
- c) to provide a forum of discussions of the present developments in the different laboratories and to discuss these among colleagues.

The fact that all participants stayed in the same hotel helped a lot to achieve all these goals and many informal scientific discussions were possible.

All the seminars can be downloaded from the homepage of the workshop:

<http://theory.gsi.de/~ebratkov/Conferences/STRONG2021/index.html>

It would be a very personal choice to identify the highlights of the workshop but progress has been reported from different approaches to precise the equation of state of strongly interaction matter. Also the yearlong problem of how it can be that in a heat bath with a temperature of more than 100 MeV composite particles with a binding energy of around 5 MeV can survive, has been addressed and a solution has been proposed. Finally, the theory of open quantum system allows for a new view on the production of quarkonia in heavy ion reactions.

16th International Workshop on Meson Physics - MESON 2021

Piotr Salabura and Damian Gil (Jagiellonian University, Krakow)

16th International Workshop on Meson Physics which was supposed to be held in 2020 was postponed and finally took place between 17 and 20 May 2021. The workshop has a long standing tradition and is organized every 2 years by the Institute of Physics of Jagiellonian University, Forschung Zentrum Juelich, INFN-LNF Frascati and Institute of Nuclear Physics Polish Academy of Science. This year, due to the pandemic situation, the meeting was held on-line via Zoom platform, which unfortunately prevented participants from enjoying traditional long night discussions after conference sessions in the unique atmosphere of old Kraków city. Regardless of this situation, more than 230 participants registered and participated in plenary and three parallel sessions, scheduled in each day, filled with many excellent talks. It is a tradition of the conference to cover a broad scientific programme rather than stay focused on some specific topic. Also this year, the conference covered many exciting topics of modern hadron physics.

During the first two days production, properties and structure of mesons composed of heavy and light quarks were widely discussed. In particular, newly discovered exotic states were presented by experimentalists and interpreted by various theoretical approaches. Other aspects lively discussed during those days were interactions of mesons with mesons and baryons in vacuum and hot and dense matter studied by means of heavy ion collisions at various energy

scales spanned by SIS at GSI to LHC. Next two days were devoted to studies of nucleon structure, nucleon-antikaon and hyperon-nucleon interactions. In particular, one should single out new results of precision experiments searching for neutron dipole moment and new results of proton radius. Presented results of experimental and theoretical studies of hyperon-nucleon correlation functions in heavy ion collisions reveal an exciting possibility to access respective interaction potentials. This in turn, as argued during the conference, might have an important impact on the understanding of the nature of compact neutron stars and provide a strong link between hadron physics and astrophysics. Finally, the last day session was concluded with a presentation of new exciting results of the g-2 experiment at Fermilab and a mysterious signal of a new X17 particle claimed to be a candidate for dark photon. It is of course not possible to list all interesting topics discussed in the conference in this short report. We recommend all interested readers to look into a collection of talks gathered on the conference web page which is open for everybody (<https://meson.if.uj.edu.pl>).

Some presentations, with permission of speakers, were recorded and can be replayed by those who registered to the conference.

The next MESON conference will be organized in 2023 in an “old good traditional mode” and the organizing team already cordially invites all interested! Please stay tuned and watch the conference web page: [MESON Conference web page](#)

The STRONG-2020 Public Lecture Series

A new format of public outreach during the Covid-19 pandemic

The series of the STRONG-2020 public lectures was continued with four lectures which dealt with various aspects of the strong interaction and research in this field. On March 11, 2021, Mikhail Bashkanov, Alessandro Pastore and Dan Watts from the University of York (UK) gave the lecture entitled “Six quarks for Muster Mark?”, where they discussed the evidence and potential astrophysics impact of the “d*” hexaquark – made of six quarks.

On April 21, 2021, Hans Ströher from the Institute for Nuclear Physics, Department of Experimental Hadron Dynamics at Forschungszentrum Jülich GmbH (Germany) spoke about “The Beauty and the Power of Spin”, lecture in which he presented examples of how polarization is used at the Cooler Synchrotron COSY at the Institute for Nuclear Physics, Department of Experimental Hadron Dynamics at Forschungszentrum Jülich GmbH (Germany) for investigating of fundamental questions such as the matter-antimatter asymmetry of our Universe and the nature of Dark Matter.

On July 8, 2021, Graziano Venanzoni from INFN Pisa (Italy) and Massimo Passera from INFN Padova (Italy) spoke about “The g-2 of the muon: a probe towards new physics?”

where they reported the first results of the new Muon $g-2$ experiment at Fermilab, and discussed the theoretical implications of the new results, which increases the discrepancy with the Standard Model prediction and strengthens the request for new physics, even if, on the other hand, recent QCD lattice calculations weakens the discrepancy.

Finally, on October 1, 2021, Andrea Signori from University and INFN Pavia (Italy) and Daria Sokhan, from CEA Saclay (France) and University of Glasgow (UK) spoke about “The proton in 3D: unravelling the world within” where they discussed some key aspects of "nucleon tomography", namely the investigation of the structure of nucleons through Quantum Chromodynamics (QCD), focusing on the strong interplay between theory and experiments and presenting the existing and future machines that will provide groundbreaking information to help us dig into the mysteries at the core of matter.

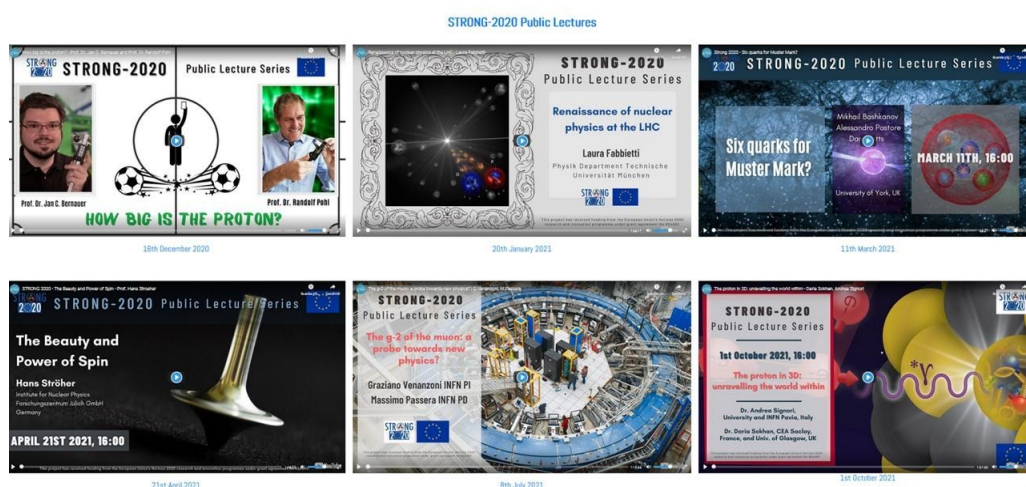
The audience was very diverse reaching from high-school students to researchers of the STRONG-2020 community and beyond. The success of the series of course crucially depended on the quality of the speakers, who were capable of conveying their enthusiasm for their research fields in this format. We therefore would like to thank once more our first speakers for their fascinating presentations.

New Public Lectures are in preparation and we invite the STRONG-2020 Community to propose new ones! The Public Lectures can be found at the links:

https://www.youtube.com/playlist?list=PLRuUrPCVVPFIqjT_o4A7iPEPj26N_OOA6s

and on the STRONG-2020 dedicated web page:

<http://www.strong-2020.eu/events/live-events.html>



An interview with Gert Aarts - ECT* Director

"ECT fulfills its role of international gather point also in these times" says Gert Arts director of the European Center for Theoretical Studies (ECT*). More about his views on the current status and the future ahead, including physics developments, in the interview with the Strong-2020 Dissemination Board 's members Piet Mulders and Maria Paola Lombardo.*



Good morning Gert, so you are sitting in the sun lovely weather in Trento. Are you there for long?

After working remotely for most of the pandemic, I am here in Trento now for the current workshop, the first one that we are running in hybrid mode, very happy about that.

Glad to know that. So, the workshop season is running well?

After the start of the pandemic, it took some time to get organised, but for 2021, we are happy to see a full program. The online workshops are working fine, although we do miss the face-to-face interactions. Also, fitting time zones put some extra pressure on the program, as clearly we wish to accommodate East and West as much as possible.

Of course a further disadvantage is that people may more easily jump in and out from the talk.

This is true; on the other hand, there are advantages in terms of inclusivity and equality; less opportunity to follow everything, more opportunities to follow at least something. I would really like to thank the community for its support of the online programs, which were

essential in keeping ECT* visible on the international stage, and also to keep science going of course.

How about training?

This year, we ran a Doctoral Training Program on "High-Energy and Nuclear Physics within Quantum Technologies", and a TALENT school on "Machine Learning applied to Nuclear Physics, Experiment and Theory", both online of course. Attendance and participation were good, I would like to thank here especially the coordinators, Enrique Rico Ortega and Morten Hjorth-Jensen respectively, and the ECT* staff, for making this activities run smoothly.

In conclusion, would you say that ECT* fulfills its role of international gather point also in these times?

Absolutely yes. And I feel that we should keep some of the positive hybrid structure in the future, albeit with more and more accent on face-to-face participations. For instance, there should be no constraints on scheduling, which will be tailored for people attending in person. Still, there will be the possibility for remote interaction and watching video afterwards. Since all meetings will be Zoom as well, they will also all be recorded and placed on the ECT* YouTube channel.

How about researchers life?

Well, people worked from home and for the ECT* researchers this is the same as for everyone else in academia. It works, but one should realise it may be harder for postdocs than for senior people in that they may have a more comfortable conditions at home.

Did you have Zoom gathering, social occasions, etc?

Since my arrival as Director, we have held weekly group meetings, including internal (and external) seminars. Partly this was for my own benefit, as I got to know the researchers this way quite well. Let me also add something important for the group in general. For a long time ECT* has hosted formally separate groups of researchers. This year, we have tried to remove the formal splitting and artificial barriers as much as possible, in order for the local research environment to function as a group working as one.

This is truly excellent and shows that ECT* still fulfills its interdisciplinary mission, besides its international one.

Indeed, coming back to the international mission, and local activities, let me say a few more words. As the pandemic develops, we still have limitations on the number of participants who can participate in person, we have to comply with local health guidelines and we cannot say when the Center will be completely open. But to make the hybrid/on-line experience as effective as possible, we have invested around 25000 euros into cameras, microphones etc. This makes a difference in the quality of the talks, with multiple cameras views, the flow from

local questions and questions for the audience is indeed very natural, and the integration of people in the Aula Renzo Leonardi and on Zoom works better. It makes a great difference.

Is the local University involved?

We have been strengthening our interaction with the University - ECT* has permanent staff and postdoctoral researchers who can very effectively contribute to academic life, and vice-versa. This summer, we have signed a MOU with Trento University and the Physics Department, which, for instance, grants ECT* staff access to University facilities, and guarantees office space to University members. 2 PhD students, match-funded with the University, will commence their studies in November. Once normal conditions resume, I am looking forward to welcoming University staff and PhD students at ECT*.

In the past, there were concerns that a link with local University may hamper the international profile of the Center.

I feel that this really belongs to the past. In particular, the presence of a local permanent research group makes very natural the development of relations as I have described. The workshop and training programme is very internationally focused, but we cannot forget the local research activities.

Supporting a local research group in addition to the community activities requires funding.

I appreciate and would like to thank the impressive support from the European research community, as well as the nice, continual interactions (almost on a monthly basis during the past year) with NuPECC, with the physics department, and with INFN, in particular with Diego Bettoni, the INFN Board member in charge of ECT*. However, funding is of course essential and we hope to ensure continuing financial support from national funding agencies.

We are also receiving funds from Strong-2020: if you browse the workshop list, you will see that many workshops receive STRONG-2020 support.

Indeed, and we will make sure that these workshops are described in our newsletter.

I really would like to express my thanks to STRONG-2020!

Let's talk a bit about the future ahead, including physics development - what is your vision for the future?

Nuclear physics is a mature subject, but ECT* has always proudly looked at it in the broadest sense. There are many developments that can be applied to nuclear physics and for which nuclear physics and related areas can provide input and questions. For instance, current developments in quantum technologies and machine learning fit perfectly in the ECT* mission: they are motivated by outstanding issues in nuclear physics and the related areas; and, at the same time, tools and idea developed by the ECT* community may find applications in these fields. ECT* can play a leadership role here, in embracing new

directions and providing training for the next generation. And, again about future, I very much look forward to welcoming everyone here again!

Thank you Gert!

Thank you, and I am running now to the opening talk of today session! On Machine Learning as it happens.

Commemorations

As STRONG 2020 community, we would like to remember our colleagues who sadly passed away in the last months. Our deep condolences to their families

[Prof. SIMON EIDELMAN](#)



[Prof. MAXIM POLIAKOV](#)



[Prof. INGO SICK](#)

