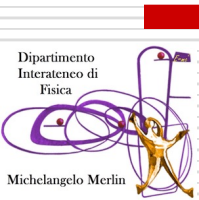


The Review Paper of the network activity HF-QGP in STRONG-2020



Giuseppe E Bruno

Dipartimento di Fisica and INFN – Bari –Italy



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093.

ECT*, hybrid format - November the 18th 2021

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Outline:

- What is STRONG-2020
- The Network Activity HF-QGP
 - structure
 - objectives
 - Review paper

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093.

ECT*, on-line - April the 26th 2021

STRONG-2020

- STRONG-2020 "*The strong interaction at the frontier of knowledge: fundamental research and applications*" has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 824093
- Coordinator of the project: Barbara Erazmus
- Web site: <http://www.strong-2020.eu/>

Consortium Agreement



- **45 participating institutions** (beneficiaries) in
- **16 countries:**
 - Austria, Belgium, Switzerland, Germany, Spain, Finland, France, Croatia, Ireland, Italy, Montenegro, Netherlands, Poland, Portugal, Sweden, United Kingdom
- **Location details can be found on [online Google map](#)**
- **134 other Involved Institutions** (not receiving EU funding)

Grant Agreement

Project duration: from 1 June 2019 to 31 May 2023 (initial)

Total Budget: 10 M €

32 Work Packages (WPs):

- **MAN:** Management and Coordination
- **DISCO:** Dissemination and Communication
- 7 Transnational Access Research Infrastructures (**TA**)
- 2 Virtual Infrastructures (**VA**)


Experimental /Theoretical /Instrumentation Activities:

- 7 Networking Activities (**NA**)
- 14 Joint Research Activities (**JRA**)



Web site: <http://www.strong-2020.eu/>

Transnational Access

- TA1-COSY (Julich)
 - TA2-MAMI (Mainz)
 - TA3-LNF (INFN, Frascati)
 - TA4-FTD/ELSA (Bonn)
 - TA5-GSI (GSI, Darmstadt)
 - TA6-ECT* (Trento) 
 - TA7-CERN (CERN, Geneva)
- The selection of infrastructure complement each other and allow for the exploration of specific strong interaction physics questions with different probes, such as electromagnetic probes at the electron machines or hadronic probes at the hadron machines, covering a broad range of energies.

Virtual Access

- VA1-NLOAccess
Jean-Philippe Landsberg, CNRS, Orsay
- VA2-3DPartons
Hervé Moutarde CEA, Saclay
- Provide open-access to state-of-the-art computer codes necessary for the high-precision phenomenology of heavy ion reactions and studies of the quark gluon plasma as well as for nucleon and nuclei parton structure research.

The Network Activity HF-QGP

- NA7: Quark-Gluon Plasma characterisation with heavy flavour probes (Hf-QGP)
- Objective: support the joint efforts of experimentalists and theorists in characterizing the properties of the QGP at the LHC energies using Heavy Flavour observables
- Coordinators: Joerg Aichelin and G.B.
- Budget: mostly for workshops and meetings/visits plus about 1 year of post-doc in theory and in experiment

The Network Activity HF-QGP

□ Structure of the networking:

3 sub-groups:

■ Open Heavy Flavour

□ conveners: Andrea Rossi (ALICE), Salvatore Plumari (th.)

■ Quarkonia

□ conveners: Emilien Chapon (CMS) and Enrico Scomparin (ALICE), Alexander Rothkopf (th.)

■ Small System

□ conveners: Zaida Conesa del Valle (ALICE) and Benjamin Audurier (LHCb), Andrea Beraudo (th.)

Mailing list: STRONG2020-HF_QGP@cern.ch

■ you are welcome to subscribe

A main objective: the review paper

- The network activity is expected to produce a review paper
 - At the time of proposal (2017) formulated as "*Paper with perspectives and recommendations for the dedicated heavy-ion periods of LHC after the 2nd Long Shutdown for the different LHC experiments*"
 - The idea at that time was to give a review of run2 results and focus on perspectives for run3 and run4

The review paper

- There is ample flexibility from the STRONG-2020 side concerning the content and focus of the review paper
 - we should produce what we feel relevant and timing
 - my feeling is that focus should go to run5
- Estimated time for this deliverable 31/05/2023
 - First draft ready on 1/12/2022 (milestone of the project)

The review paper

□ Since 2017 a lot has been done

■ CERN yellow report - WG5 **“Future physics opportunities for high-density QCD at the LHC with heavy-ion and proton beams”**

<https://cds.cern.ch/record/2650176>



2019

CERN-LPCC-2018-07
February 26, 2019

Future physics opportunities for high-density QCD at the LHC with heavy-ion and proton beams

Report from Working Group 5 on the Physics of the HL-LHC, and Perspectives at the HE-LHC

Editors:

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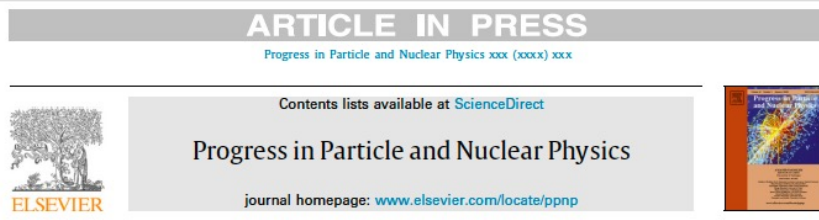
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5	Open heavy flavour	49
5.1	Perspectives for heavy-flavour observables in LHC Run 3 and 4	49
5.2	Impact of detector upgrades on heavy-flavour measurements	50
5.3	Nuclear modification factor and collective flow	51
5.4	Studies of heavy-quark hadronisation	55
5.5	Heavy-flavour correlations and jets	59
5.6	Sensitivity to early magnetic fields and vorticity phenomena	61
5.7	Heavy flavour measurements in small colliding systems	61
7	Quarkonia	81
7.1	Introduction	81
7.2	Charmonia in Pb–Pb collisions	83
7.3	Bottomonia in Pb–Pb collisions	85
7.4	Quarkonia in p–Pb and pp collisions	88
8	Electromagnetic radiation	92

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□ E. Chapon et al. “Prospects for quarkonium studies at the high-luminosity LHC”, Progress in Particle and Nuclear Physics, in press, arXiv:2012.14161



Review

Prospects for quarkonium studies at the high-luminosity LHC

Émilien Chapon^{1,a}, David d’Enterria^{2,a}, Bertrand Ducloué^{3,a}, Miguel G. Echevarria^{4,a}, Pol-Bernard Gossiaux^{5,a}, Vato Kartvelishvili^{6,a}, Tomas Kasemets^{7,a}, Jean-Philippe Lansberg^{8,a,b}, Ronan McNulty^{9,a}, Darren D. Price^{10,a}, Hua-Sheng Shao^{11,a}, Charlotte Van Hulse^{9,a}, Michael Winn^{12,a}, Jaroslav Adam¹³, Liupan An¹⁴, Denys Yen Arrebato Villar⁵, Shohini Bhattacharya¹⁵, Francesco G. Celiberto^{16,17,18,19}, Cvetan Cheshkov²⁰, Umberto D’Alesio²¹, Cesar da Silva²², Elena G. Ferreira²³, Chris A. Flett^{24,25}, Carlo Flore⁸, Maria Vittoria Garzelli^{26,14,27}, Jonathan Gaunt^{28,10}, Jibo He²⁹, Yiannis Makris¹⁷, Cyrille Marquet³⁰, Laure Massacrier⁸, Thomas Mehen³¹, Cédric Mezrag¹², Luca Micheletti³², Riccardo Nagar³³, Maxim A. Nefedov³⁴, Melih A. Ozcelik⁸, Biswarup Paul²¹, Cristian Pisano²¹, Jian-Wei Qiu³⁵, Sangem Rajesh²¹, Matteo Rinaldi³⁶, Florent Scarpa^{8,37}, Maddie Smith⁶, Pieter Taelis³⁰, Amy Tee⁶, Oleg Teryaev³⁸, Ivan Vitev²², Kazuhiro Watanabe³⁵, Nodoka Yamanaka^{39,40}, Xiaojun Yao⁴¹, Yanxi Zhang^{2,42}

5. Proton–nucleus collisions	40
5.1. Introduction	40
5.2. Cold-nuclear-matter effects in Q production	40
5.2.1. Theoretical models: setting the scene	40
5.2.2. Improved constraints on nPDFs from LHC data	43
5.2.3. pA collisions at the FT-LHC: high-precision input for global nPDF fits	44
5.2.4. Developments in theory and phenomenology of QCD at low x and its connection to Q production	44
5.2.5. Discrimination of different nuclear effects with new measurements	46
5.3. Flow-like phenomena in Q production	47
5.3.1. Theoretical prospects	47
5.3.2. Experimental prospects	47
5.3.3. Azimuthal anisotropies from initial-state effects	48
5.4. Q -hadronisation studies	48
5.4.1. Theoretical status	48
5.4.2. Experimental prospects	50
6. Nucleus–nucleus collisions	52
6.1. Introduction and context	52
6.2. Recent theory developments	55
6.2.1. Semi-classical transport and open quantum system	56
6.2.2. A density-operator model for Q production in AA collisions	57
6.2.3. An advanced EFT for Q in matter	58
6.3. Opportunities at HL-LHC	60
6.3.1. Studying the collision-energy dependency of Q production	60
6.3.2. Prospects for $X(3872)$ studies	61
6.3.3. ψ polarisation in $PbPb$ collisions	61

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-
- work for the Letter of Intent of **“A next-generation LHC heavy-ion experiment”**
 - follow-up of the EoI ([arXiv:1902.01211](https://arxiv.org/abs/1902.01211)) presented as an input to the 2020 Update of the European Particle Physics Strategy
 - **Open workshop last October**
 - <https://indico.cern.ch/event/1063724/>
 - LoI in finalization

In all cases strong and fundamental contribution from the theory community

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Focus and scope of the document

- LHC Run5&6 and heavy flavour
- Complete and extend the studies done recently
 - For the ALICE3 LoI, in most cases, exemplary performances for channels / items out of reach with run4 have been derived
 - E.g. two (HF) particle correlations, multi-charmed baryons
 - other items considered, but need more tuning:
 - Exotic hadrons, c-nuclei, HF-photons, HF femtoscopy
 - An assessment of expected physics reach at the end of run4 (and what we can learn further from run5) with also more conventional observables (e.g. v_2 of beauty) still very important to prepare at best the HI physics programs of the different LHC experiments with run5&6

Review paper: next actions

- Dedicated meeting of the network in January 2022
- Form an editorial team
- Present the idea of the document in one of the next meeting of the recently formed Heavy Ion WG of LPCC
- <https://lpcc.web.cern.ch/content/lhc-hi-wg>