

STRONG2020 NA2-Small-x: Physics at the LHC and future DIS experiments - Interim Report
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USC: RPI (first 18 months)

Néstor Armesto

IGFAE, Universidade de Santiago de Compostela

nestor.armesto@usc.es

Brief intro:

- Nuclear PDFs unknown below $x \sim$ a few 10^{-2} (Task 1, D13.1, MSI 1):
 - ⇒ lack of understanding of nuclear structure/dynamics;
 - ⇒ uncertainties in perturbative observables in nuclear collisions (hard probes), used to understand and characterise the hot partonic medium produced in HICs at RHIC / LHC.

Use of LHC data (EW bosons, jets, D and B mesons, quarkonia,...) and eA colliders.

- Azimuthal correlations (ridge) in small systems (pp, pA) similar to those found in AA (Task 4, D13.4, MSI 4):
 - ⇒ initial or final state effects?;
 - ⇒ Initial conditions for thermalisation/isotropisation and the use of viscous hydrodynamics.

CGC gives initial state explanation but odd harmonics demand additional input (subleading density effects, non-eikonal corrections, non-trivial hadron structure) and extension from pp (glasma graphs, 2-g exchange) to pA, hard to accomplish analytically (dipoles, quadrupoles,...).

Results: nPDFs

- Perspectives for nPDFs determination in Runs 3 and 4, and with lighter ions in Run 5 on.
Report from Working Group 5 : Future physics opportunities for high-density ^{#7}
QCD at the LHC with heavy-ion and proton beams
[Z. Citron](#) (Ben Gurion U. of Negev), [A. Dainese](#) (INFN, Padua), [J.F. Grosse-Oetringhaus](#) (CERN), [J.M. Jowett](#) (CERN), [Y.-J. Lee](#) (MIT) et al. (Dec 17, 2018)
Published in: *CERN Yellow Rep.Monogr.* 7 (2019) 1159-1410 • Contribution to: [HL/HE-LHC Workshop](#), 1159-1410
• e-Print: [1812.06772](#) [hep-ph]
- Perspectives for nPDFs determination at the LHeC and FCC-eh.
The Large Hadron-Electron Collider at the HL-LHC
[LHeC Collaboration](#) and [FCC-he Study Group](#) • [P. Agostini](#) (Santiago de Compostela U.) et al. (Jul 28, 2020)
e-Print: [2007.14491](#) [hep-ex]
- [Persons: N. Armesto, C. Salgado, P. Paakkinen \(with Jyväskylä\).](#)
- Ongoing: possibilities for disentangling resummation and saturation from standard DGLAP at the LHeC and FCC-eh (Snowmass 2021 Lol).

Results: correlations

- Non-eikonal corrections for single and double gluon production and azimuthal asymmetries in pp collisions (MS14):

Non-eikonal corrections to multi-particle production in the Color Glass

#9

Condensate

[Pedro Agostini](#) (Santiago de Compostela U., IGFAE), [Tolga Altinoluk](#) (NCBJ, Warsaw), [Néstor Armesto](#) (Santiago de Compostela U., IGFAE) (Feb 12, 2019)

Published in: *Eur.Phys.J.C* 79 (2019) 7, 600 • e-Print: [1902.04483](#) [hep-ph]

Effect of non-eikonal corrections on azimuthal asymmetries in the Color Glass

#5

Condensate

[Pedro Agostini](#) (Santiago de Compostela U., IGFAE), [Tolga Altinoluk](#) (NCBJ, Warsaw), [Néstor Armesto](#) (Santiago de Compostela U., IGFAE and CERN) (Jul 8, 2019)

Published in: *Eur.Phys.J.C* 79 (2019) 9, 790 • e-Print: [1907.03668](#) [hep-ph]

- Review:

Particle correlations from the initial state

[Tolga Altinoluk](#) (NCBJ, Warsaw), [Néstor Armesto](#) (Santiago de Compostela U.) (Apr 17, 2020)

Published in: *Eur.Phys.J.A* 56 (2020) 8, 215 • e-Print: [2004.08185](#) [hep-ph]

- Persons: [P.Agostini](#), [N.Armesto](#) (with [NCBJ](#), [École Polytechnique](#), [BNL](#),...).
- Ongoing: extension to pA in single and double inclusive with non-eikonal corrections (Snowmass 2021 Lol), 4-particle correlations, multiplicity and p_T - v_2 correlations,...; NLO photon production in the hybrid formalism,...

People/money:

- **People at USC:**
 - 2 staff (NA and Carlos Salgado);
 - 1 postdoc (Petja Paakkinen);
 - 1 PhD student (Pedro Agostini co-supervised with Tolga Altinoluk from NCBJ);
 - 1 postdoc to come in April 2021 (1.5 years in Jyväskylä from 10/20, then 1.5 years at USC): Florian Cougoulic (now at OSU).

- **No money spent: first mess with support to beneficiaries/non-beneficiaries, then COVID.**

Conclusions:

THANK YOU!!!



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Report (II):

2. Use of resources

2.1 Use of financial resources

2.2 Use of human resources

Beneficiary number	Organization legal name <i>(in italics the Research Units)</i>	Short name	Human effort from Annex I <i>(person-months for 18 months)</i>	Actual human effort in the reporting period <i>(person-months)</i>
1	<i>Centre National de la Recherche Scientifique</i>	CNRS	4,50	
20	<i>Universidad de Santiago de Compostela</i>	USC	2,25	
23	<i>Jyvaskylan Yliopisto</i>	JYU	2,40	
37	<i>The Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences</i>	IFJ PAN	4,50	

2.3 Use of other resources

Report (IV):

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D13.1	NPDFs	23 - JYU	Report	Public	48
D13.2	Resummed NLO cross sections	1 - CNRS	Report	Public	36
D13.3	TMD factorization	37 - IFJ PAN	Report	Public	48
D13.4	Initial vs final state correlations	20 - USC	Report	Public	36

4. Deliverables and milestones tables

4.3 Deliverable reports (description)

MS11	Reweightings of nPDFs including new LHC data	WP13	20 - USC	24	Publications and presentations in conferences, and software released and validated by a user group
MS12	Dipole cross section from resummed JIMWLK evolution	WP13	20 - USC	24	Publications and presentations in conferences, and software released and validated by a user group
MS13	TMD factorization at small x for 3 final-state particles	WP13	20 - USC	24	Publications and presentations in conferences
MS14	Completion of the calculation of multi-particle correlations in the dilute limit of the CGC	WP13	20 - USC	24	Publications and presentations in conferences