

# The *Quarkonia as Tools* workshop series: change the paradigm

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IJCLab Orsay – Paris Saclay U. – CNRS

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GDR QCD Annual meeting,

March 8-10, 2021



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- A seemingly unsolvable puzzle : quarkonium production !



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  - 26 talks,
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  - Virtual meeting;
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- QaT' 2021 : hopefully in Aussois during the week of June 20, 2021.

# Quarkonia as Tools legacy so far ...

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## Perspectives for quarkonium studies at the high-luminosity LHC

Émilien Chapon<sup>a,1</sup>, David d'Enterria<sup>b,1</sup>, Bertrand Ducloux<sup>c,1</sup>, Miguel G. Echevarria<sup>d,1</sup>,  
Pol-Bernard Gossiaux<sup>e,1</sup>, Vato Kartvelishvili<sup>f,1</sup>, Tomas Kasemets<sup>g,1</sup>, Jean-Philippe Lansberg<sup>h,2</sup>,  
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Pieter Taelis<sup>ae</sup>, Amy Tee<sup>f</sup>, Oleg Teryaev<sup>am</sup>, Ivan Vitev<sup>w</sup>, Kazuhiro Watanabe<sup>aj</sup>, Nodoka Yamanaka<sup>am,ao</sup>,  
Xiaojun Yao<sup>ap</sup>, Yanxi Zhang<sup>ba,aa</sup>

### Abstract

We review the prospects for quarkonium-production studies in proton and nuclear collisions accessible during the upcoming phases of the CERN Large Hadron Collider operation after 2021, including the ultimate high-luminosity phase, with increased luminosities compared to LHC Runs 1 and 2. We address the current experimental and theoretical open issues in the field and the perspectives for future studies in quarkonium-related physics through the exploitation of the huge data samples to be collected in proton-proton, with integrated luminosities reaching up to  $\mathcal{L} = 3 \text{ ab}^{-1}$ , in proton-nucleus and in nucleus-nucleus collisions, both in the collider and fixed-target modes. Such investigations include, among others, those of: (i) the quarkonia produced in association with other hard particles; (ii) the  $\chi_Q$  and  $\eta_Q$  down to small transverse momenta; (iii) the constraints brought in by quarkonia on gluon PDFs, nuclear PDFs, TMDs, GPDs and GTMDs, as well as on the low- $x$  parton dynamics; (iv) the gluon Sivers effect in polarised-nucleon collisions; (v) the properties of the quark-gluon plasma produced in ultra-relativistic heavy-ion collisions and of collective partonic effects in general; and (vi) double and triple parton scatterings.

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- Aim: write an add-on about quarkonium production to the EIC Yellow Report

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