
Professional experience

since Aug. 2023 **Assistant Professor of Physics** at the Facility for Rare Isotope Beams (FRIB), *Michigan State University (MSU)*, USA.

Research interests :

- Direct reactions (elastic-scattering, breakup, nucleon knockout, transfer)
Improvements of few-body models
Halo-EFT description of projectiles
- *Ab initio* prediction of reactions of astrophysical interests
- Development of optical potentials from *ab initio* theory
- Uncertainty quantification for reactions

Oct. 2020 **FRIB Theory Fellow**, *MSU and Lawrence Livermore National Laboratory (LLNL)*, USA.
– Aug. 2023

Education

Oct. 2016 **PhD in Nuclear Physics** (FRIA Scholar), Université libre de Bruxelles (ULB), Belgium. Advisor : Prof. Pierre Capel.
– Sep. 2020

Title : *Study of the Eikonal Approximation to Model Exotic Reactions.*

Particular focus on elastic-scattering, breakup and nucleon knockout reactions :

- Study of corrections to the eikonal approximation at low-energy
- Inclusion of dynamical effects within eikonal description of reaction
- Knockout probe of the single-particle structure of nuclei

2013 – 2016 **Master of Science in Physical Engineering**, *Magna Cum Laude*, ULB, Belgium. Advisor : Pierre Capel.

Master's thesis : Study of corrections to the eikonal approximation.

2013 – 2016 **Bachelor in Economics**, *Cum Laude*, ULB, Belgium.

2010 – 2013 **Bachelor of Science in Engineering**, *Satis bene*, ULB, Belgium.

Awards and fellowships

Oct. 2020 FRIB-Theory fellowship, *FRIB Theory Alliance*, USA.

– Aug. 2023 Host institution : LLNL.

Sep. 2021 PhD Solvay Awards, *Solvay*, Belgium.

Oct. 2016 FRIA fellowship : four-year grant awarded for the completion of a PhD,
– Sep. 2020 *Fonds de la Recherche Scientifique (F.R.S.-FNRS)*, Belgium.

Oct. 2018 Three different credits for a scientific stay at Johannes-Gutenberg Universität Mainz, *F.R.S.-FNRS*, Belgium.
– Sep. 2020

Jan. 2017 Best poster, *55th International Winter Meeting on Nuclear Physics*, Bormio, Italy.

Teaching experience

- Fall semester 2023 Physics for life scientists (PHY-222), MSU.
2017 – 2018 Teaching Assistant in Mathematics, ULB, 2nd year in Economics.
2016 – 2018 Teaching Assistant in Quantum and Statistical Physics, ULB, 2nd year in Engineering.
2016 – 2018 Teaching Assistant in Introduction to Microeconomics, ULB, 1st year in Mathematics.

Current graduate student

since Aug. 2023 Andrew Smith.

Current undergraduate student

since Nov. 2023 Daniel Shiu.

Workshops organized

- June 2024 Co-organizer of one-week ECT* workshop : Towards a consistent approach for nuclear structure and reactions : microscopic optical potentials. Italy. Co-organizers : C. Barbieri (Università degli Studi di Milano Statale), C. Elster (OU), A. Obertelli (TU Darmstadt).
- Aug. 2022 Co-organizer of [FRIB-TA Topical Program: Few-body cluster structures in exotic nuclei and their role in FRIB experiments](#). Two-weeks program at FRIB, USA, co-organizers : K. Fossef (FSU), S. König (NCSU), L. Platter (UTK/ORNL).
- Mar. 2022 Lead organizer of [FRIB-TA Topical Program: Optical Potentials in Nuclear Physics](#). Two-weeks program at FRIB, USA, co-organizers : G. Potel (LLNL), F. Nunes (MSU/FRIB), W. Dickhoff (WUSL) and J. Holt (TAMU). Deliverables : [White paper on Optical potentials for the rare-isotope beam era](#) and a [website](#) gathering reaction codes and optical potential parametrizations.

Services

- Referee for Physical Review C, European Physical Journal A, Few-Body Systems, Journal of Physics G : Nuclear and Particle Physics, Computer Physics Communication.
Panel reviewer for Department of Energy, Office of Science Nuclear Physics.
- 2023 Member of the FRIB Theory Fellow Search Committee, FRIB-TA.
- Feb. 2022 – Feb. 2023 Co-organizer with Wei Jia Ong (LLNL) of a online seminar series attended by the nuclear and data theory group (NDT) and the nuclear physics and accelerator technology (NPAT) at LLNL. Every two weeks.
- 2016 – 2018 Representative for the scientific staff at the Faculty of Engineering, ULB, Belgium.

Outreach

- 2019 – 2020 Co-organizer of the Mainz Pint of Science.
Cancelled due to the pandemic
- March 2018 Facilitator for lab work in electricity for 8th grade students. Organized for the event "Printemps des Sciences" by the Engineering Faculty, ULB, Belgium.

Publications in Refereed Journals

- [1] [C. Hebborn](#), F. M. Nunes and A. E. Lovell, *New perspectives on spectroscopic factor quenching from reactions*, [Phys. Rev. Lett. **131**, 212503 \(2023\)](#).
- [2] K. Kravvaris, P. Navrátil, S. Quaglioni, [C. Hebborn](#) and G. Hupin, *Ab initio informed evaluation of the radiative capture of protons on ^7Be* , [Phys. Lett B, 138156 \(2023\)](#).
- [3] [C. Hebborn](#), T. R. Whitehead, A. E. Lovell, F. M. Nunes, *Quantifying uncertainties due to optical potentials in one-neutron knockout reactions*, [Phys. Rev. C **108**, 014601 \(2023\)](#).
- [4] D. Bazin, K. Becker, F. Bonaiti, Ch. Elster, K. Fosse, T. Frederico, A. Gnech, [C. Hebborn](#), M. Higgins, L. Hlophe, B. Kay, S. König, K. Kravvaris, J. Lubian, A. Macchiavelli, F. Nunes, L. Platter, G. Potel and X. Zhang, *Perspectives on few-body cluster structures in exotic nuclei*, [Few-Body Syst. **64**, 25 \(2023\)](#).
- [5] [C. Hebborn](#), F. M. Nunes, G. Potel, W. H. Dickhoff, J. W. Holt, M. C. Atkinson, R. B. Baker, C. Barbieri, G. Blanchon, M. Burrows, R. Capote, P. Danielewicz, M. Dupuis, Ch. Elster, J. E. Escher, L. Hlophe, A. Idini, H. Jayatissa, B. P. Kay, K. Kravvaris, J. J. Manfredi, A. Mercenne, B. Morillon, G. Perdikakis, C. D. Pruitt, G. H. Sargsyan, I. J. Thompson, M. Vorabbi and T. R. Whitehead, *Optical potentials for the rare-isotope beam era*, [J. Phys. G: Nucl. Part. Phys. **50**, 060501 \(2023\)](#).
- [6] [C. Hebborn](#) and G. Potel, *Green's Function Knockout formalism*, [Phys. Rev. C **107**, 014607 \(2023\)](#).
- [7] [C. Hebborn](#), G. Hupin, K. Kravvaris, S. Quaglioni and P. Navrátil, *Ab initio prediction of the radiative capture $^4\text{He}(d, \gamma)^6\text{Li}$* , [Phys. Rev. Lett. **129**, 042503 \(2022\)](#).
- [8] [C. Hebborn](#) and F. M. Nunes, *Considering non-locality in the optical potentials within eikonal models*, [Phys. Rev. C **104**, 034624 \(2021\)](#).
- [9] [C. Hebborn](#) and P. Capel, *Halo effective field theory analysis of one-neutron knockout reactions of ^{11}Be and ^{15}C* , [Phys. Rev. C **104**, 024616 \(2021\)](#).
- [10] [C. Hebborn](#) and P. Capel, *Detailed study of the Eikonal Reaction Theory for the breakup of one-neutron halo nuclei*, [Phys. Rev. C **103**, 064614 \(2021\)](#).
- [11] [C. Hebborn](#) and D. Baye, *Simplified dynamical eikonal approximation*, [Phys. Rev. C **101**, 054609 \(2020\)](#).
- [12] [C. Hebborn](#) and P. Capel, *Sensitivity of one-neutron knockout to the nuclear structure of halo nuclei*, [Phys. Rev. C **100**, 054607 \(2019\)](#).
- [13] [C. Hebborn](#) and P. Capel, *Low-energy corrections to the eikonal description of elastic scattering and breakup of one-neutron halo nuclei in nuclear-dominated reactions*, [Phys. Rev. C **98**, 044610 \(2018\)](#).
- [14] [C. Hebborn](#) and P. Capel, *Analysis of corrections to the eikonal approximation*, [Phys. Rev. C **96**, 054607 \(2017\)](#).

Submitted

- [1] [C. Hebborn](#), M. L. Avila, K. Kravvaris, G. Potel and S. Quaglioni, *Impact of the ^6Li asymptotic normalization constant onto α -induced reactions of astrophysical interest*, [submitted](#).

- [2] C. Hebborn and P. Capel, *Sensitivity of one-neutron knockout observables of loosely- to more deeply-bound nuclei*, [submitted](#).

Conference proceedings

- [1] P. Navratil, K. Kravvaris, P. Gysbers, C. Hebborn, G. Hupin and S. Quaglioni, *Ab initio investigations of $A=8$ nuclei : α - α scattering, deformation in ^8He , radiative capture of protons on ^7Be and ^7Li and the $X17$ boson*, [Proc. of 28th International Nuclear Physics Conference](#), Cape Town, South Africa, (2022).
- [2] C. Hebborn and P. Capel, *Sensitivity of one-neutron knockout of halo nuclei to their nuclear structure*, [Proc. of the 27th International Nuclear Physics Conference](#), Glasgow, United Kingdom, (2019), J. Phys. : Conf. Ser. **1643** 012088.
- [3] C. Hebborn, D. Baye and P. Capel, *Adiabatic correction to the eikonal approximation*, [Proc. of the International Summer School on Nuclear Physics](#), La Rábida, Spain, (2018).
- [4] C. Hebborn and P. Capel, *Study of corrections to the eikonal approximation*, Proc. of the 55th International Winter Meeting on Nuclear Physics [PoS\(BORMIO2017\)056](#), Italy, (2017).

Invited talks

11 invited talks at conferences and workshops.

15 invited colloquia and seminars.

- Oct. 2023 *Seminar at The University of Edinburgh*, Edinburgh, UK.
Title : Ab initio prediction of $\alpha(d, \gamma)^6\text{Li}$ and impact of the ^6Li properties onto alpha-induced reactions of astrophysical interest
- Aug. 2023 *Low Energy Community Meeting (LECM 2023)*, FRIB, USA.
Title : New perspectives on spectroscopic factor quenching from transfer and knockout reactions
- Aug. 2023 Plenary talk at *25th European conference on few-body problems in physics (EFB25)*, Mainz, Germany.
Title : Ab initio prediction for $^4\text{He}(d, \gamma)^6\text{Li}$ at big-bang nucleosynthesis energies
- July 2023 *Seminar at IJCLab*, Orsay, France.
Title : Ab initio prediction of $\alpha(d, \gamma)^6\text{Li}$ and impact of the ^6Li properties onto alpha-induced reactions of astrophysical interest
- April 2023 *APS April meeting*, Minneapolis, MN, USA.
Title : Ab initio prediction for $^4\text{He}(d, \gamma)^6\text{Li}$ at big-bang nucleosynthesis energies
- Mar. 2023 *Physics Division Seminar at Argonne National Laboratory*, USA.
Title : From ab initio to few-body predictions of reactions of atomic nuclei
- Mar. 2023 *Physics Colloquium during the workshop on Progress in Ab Initio Nuclear Theory*, TRIUMF, Canada.
Title : Ab initio prediction of astrophysical reaction rates and integrating microscopic calculations within few-body methods
- Feb. 2023 *VIth Edition of the series of Topical Workshops on Modern Aspects of Nuclear Structure*, Bormio, Italy.
Title : Ab initio prediction for $^4\text{He}(d, \gamma)^6\text{Li}$ at big-bang nucleosynthesis energies
- Aug. 2022 *14th Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2022)*, Lake Buena Vista, FL, USA.
Title : Neutron knockout reactions of halo nuclei and as a probe for neutron skin
- Aug. 2022 *Low Energy Community Meeting (LECM 2022)*, Argonne National Laboratory, USA.
Title : Ab initio prediction for $^4\text{He}(d, \gamma)^6\text{Li}$ and challenges for reactions involving heavier nuclei

- June 2022 *Living near unitarity*, program at the Kavli Institute for Theoretical Physics (KITP), USA.
Title : From *ab initio* to few-body description of reactions involving loosely-bound nuclei
- April 2022 *Physics Colloquium*, Michigan State University, USA.
Title : Integrated structure and reaction theories for accurate predictions in the FRIB era
- Mar. 2022 *Physics Colloquium*, University of Notre Dame, USA.
Title : Integrated structure and reaction theories for accurate predictions in the FRIB era
- Feb. 2022 *Physics Colloquium*, Louisiana State University, USA.
Title : Integrated structure and reaction theories for accurate predictions in the FRIB era
- Feb. 2022 *Physics Theory seminar*, Washington University, USA.
Title : *Ab initio* prediction of $\alpha(d, \gamma)^6\text{Li}$
- Feb. 2022 *Physics Colloquium*, Ohio University, USA.
Title : Integrated structure and reaction theories for accurate predictions in the FRIB era
- Nov. 2021 *Physics seminar*, Ohio University, USA.
Title : From *ab initio* to few-body models of reactions
- Nov. 2021 *Seminar at Physique Nucléaire et Physique Quantique*, ULB, Belgium.
Title : From *ab initio* to few-body models of reactions
- Aug. 2021 *Low Energy Community Meeting*, (LECM 2021) online.
Title : From *ab initio* description to few-body model of reactions
- June 2021 *Nuclear physics at the edge of stability* (ECT* workshop), online.
Title : Halo-EFT analyses of knockout reactions on ^{11}Be and ^{15}C
- May 2021 *Reaction Seminar 2021*, online.
Title : Analysis of one-neutron knockout observables : sensitivity to the projectile's nuclear structure and dynamical effects
- Mar. 2021 *Seminar of Nuclear Data & Theory Group*, LLNL, USA.
Title : Study of knockout reactions : from loosely- to deeply-bound nuclei
- Aug. 2020 *Low Energy Community Meeting*, (LECM 2020) online.
Title : Study of one-neutron knockout : from loosely-bound to deeply-bound nuclei
- Dec. 2019 *Seminar of National Superconducting Cyclotron Laboratory*, MSU, USA.
Title : Study of the eikonal approximation to model exotic reactions
- Nov. 2019 *Seminar of Nuclear Data & Theory Group*, LLNL, USA.
Title : Study of the eikonal approximation to model exotic reactions
- May 2019 *Seminar of the Institut für Kernphysik*, Johannes-Gutenberg Universität Mainz, Germany.
Title : What nuclear-structure information can be inferred from inclusive measurements of breakup of halo nuclei?

Contributed talks and posters

9 contributed talks and 2 posters at conferences and workshops.

- June 2022 *Direct Reaction for Exotic Beams (DREB 2022)*, Santiago de Compostela, Spain.
Title : Halo-EFT description of halo nuclei within one-neutron removal reactions
- Oct. 2021 *APS DNP meeting*, online.
Title : Considering non-locality in the optical potentials within eikonal models

- Apr. 2021 *APS April meeting, online.*
Title : Halo-EFT analyses of knockout reactions of ^{11}Be and ^{15}C
- July 2019 *27th International Nuclear Physics Conference (INPC 2019)*, Glasgow, United Kingdom.
Title : Sensitivity of one-neutron knockout of halo nuclei to their nuclear structure
- Jan. 2019 *57th International Winter Meeting on Nuclear Physics*, Bormio, Italy.
Poster : Peripherality in inclusive nuclear breakup of halo nuclei
- June 2018 *International Summer School on Nuclear Physics*, La Rábida, Spain.
Title : Adiabatic correction to the eikonal approximation
- June 2018 *Direct Reactions with Exotic Beams (DREB2018)*, Matsue, Japan.
Title : Corrections to the eikonal description of elastic scattering and breakup of halo nuclei
- Mar. 2018 *Recent advances and challenges in the description of nuclear reactions at the limit of stability (ECT* workshop)*, Trento, Italy.
Title : Low-energy corrections to the eikonal description of elastic scattering and breakup of halo nuclei
- Feb. 2017 *Unraveling the complexity of nuclear systems : single-particle and collective aspects through the looking glass (ECT* workshop)*, Trento, Italy.
Title : Extension of the eikonal approximation to low energies
- Jan. 2017 *55th International Winter Meeting on Nuclear Physics*, Bormio, Italy.
Poster : Study of corrections to the eikonal approximation
- May 2016 *Belgian Research Initiative on Exotic Nuclei (BRIX) workshop (IAP P7/12)*, Mol, Belgium.
Title : Study of corrections to the eikonal approximation

Scientific stays

- Oct. 2020 – June 2021 Five visits to the IJCLab to collaborate with Dr Guillaume Hupin, Orsay, France.
- Oct. 2018 – Sep. 2020 Two-years visit at Johannes Gutenberg-Universität Mainz to collaborate with Prof. Pierre Capel, Mainz, Germany.

Computational skills

- High performance computing tools
- Languages Fortran, Python, MPI, C
- Graphics Gnuplot, Grace, Python

Languages

- French Native speaker
- English Full professional proficiency