Léo Brunswic

Curriculum Vitae

Education

2014-2017	**PhD (Mathematics)**, *Université d'Avignon (UAPV)*, Avignon, France. Title : Polyhedral Cauchy-surfaces of singular flat spacetimes
2011–2012	**Agregation (Mathematics)**, *Ecole Normale Supérieure de Lyon (ENSL)* , Lyon, France. Nationwide competitive examination for highest teaching certification, final rank : 10th
2009–2011	**Master of Science (Mathematics)**, *ENSL*, Lyon,France. Speciality : Number Theory
2008–2009	**Bachelor of Science (Mathematics)**, *ENSL*, Lyon, France.
2005–2008	**Classe Préparatoire aux Grandes Ecoles Mathematics and Physics**, *Lycée Louis Le Grand (French top 2 mathematics undergraduate program)* , Paris, France.

Research Focus

Mainly a geometer with strong research interests for Articial Intelligence and broad (non-research) secondary mathematical interest, my research focus is threefold. Firstly, singular geometric structures, especially semi-Riemannian geometric structures. Such geometric structures can be used to model certain types of spacetimes with particles with applications in quantum gravity and cosmology. This theoretical focus includes the construction of a framework of topological spacetimes to encompass causal intuition/results in general. Secondly, averaged and large scale behaviour of solutions to Einstein's equations modeling cosmic scales of the universe. I mainly work on the scalar averaging framework of Thomas Buchert introducing integral geometry technics based upon Gauss-Bonnet-Chern Theorem and the Yamabe functionnal. Thirdly, I have a growing interest in Artificial Intelligence. Inside a collaboration, I obtained results regarding Poker AI. I'm now working for Huawei on AI related questions.

Experience

10/2021-present	**Post-doctoral researcher**, Huawei Shanghai Research station - JiaoTong University, Artificial Intelligence.

01/2018- 09/2021	**Post-doctoral researcher**, Centre de Recherche Astrophysique de Lyon *ERC advanced Grant 740021-ARThUs*, Contributions to inhomogeneous cosmologies .
2019–present	**Mathematics and Computer science Teacher**, IPESUP Group *(Top tier private schooling institution)*, Paris, France.
2019–present	**Oral examiner**, Lycée Pasteur *(top tier "classe preparatoire")*, Neuilly-sur-Seine,France. Hour-long weekly oral examination for second year undergraduate students in French "classe preparatoire" (2 hours/week).
2016–2017	**Elected member of the Faculty Research Council**, UAPV, Avignon, France.
2015–2017	**Elected member of the Math. Laboratory Council** , UAPV, Avignon, France.
2014–2017	**PhD student**, UAPV, Avignon, France. Contributions to the theory of Globally hyperbolic Cauchy-complete singular flat spacetimes of dimension 3 and its interaction with Teichmüller Theory
2013–2014	**Mathematics Teacher**, Lycée Colbert, Lyon,France. Mathematics Teacher in 10th grade, 12 hours a week.
2009–2013	**Oral examiner**, Lycée du Parc and Lycee la Martiniere Monplaisir, Lyon, France.
2011–2012	**Intern**, Centre de Recherche Astrophysique de Lyon. Contribution to averaged cosmology.

Publications

- 2017 PhD thesis : "Surfaces de Cauchy Polyédrales des espaces-temps plats singuliers" https://tel.archives-ouvertes.fr/tel-01818016
- 2016 "BTZ extensions of globally hyperbolic singular flat spacetimes" https://arxiv.org/abs/1605.05530
- 2016 "Cauchy-Compact flat spacetimes with BTZ singularities" https://arxiv.org/abs/1605.05530 submitted
- 2020 With Thomas Buchert "Gauss-Bonnet-Chern approach to the averaged Universe" Class. Quantum Grav. 37 215022 https://doi.org/10.1088/1361-6382/abae45 https://arxiv.org/abs/2002.08336
- 2020 On branched coverings of singular (G,X)-manifolds https://arxiv.org/abs/2010.10610 submitted
- 2020 "Alexandrov Theorem for 2+1 flat radiant spacetimes" https://arxiv.org/abs/2012.01275

Lectures

- "Upper bounds on non-positive relative Yamabe invariant and applications to inhomogeneous cosmology"; July 2021, CRAL, "Arthus round table" and September 2021, Avignon, "Seminar of geometry and analysis".
- "Branched coverings of singular (G,X)-manifolds"; February 2021 Grenoble (France) "Seminar of Geometry and spectral analysis".
- "Some known effects of topology on the large scale behaviour of a spacetime" March 2020, RTG Spring Workshop Hamburg (Germany)
- "Iterative scheme for solving the Einstein equation" ; September 2019, CRAL

- "Update on the GBC approach to the averaged Universe" ; September 2019, CRAL
- "Topological spacetimes : from basics to Geroch Theorem"; May 2019, CRAL
- "On singular geometric structures" ; May 2019, Fribourg university
- "Expansion and topology dynamics in dust cosmology"; September 2018, Krakow (Poland)
- "Topology dynamics in globally hyperbolic singular flat 2+1 spacetimes "; September 2018, CRAL
- "Gauss-Bonnet-Chern Theorem and selfgraviting matter" ; August 2018, Rio de Janeiros (Brazil)
- "Geometric structures and manifolds of low dimension." ; June 2018, CRAL
- "Closure with the Gauss-Bonnet-Chern-Avez theorem?"; December 2017, CRAL
- "Alexandrov Theorem for singular spacetimes" ; Gear Retreat 2017 Stanford,CA (USA).
  Places: Workshop "Teichmüller Theory and geometric structures on 3-dimensional manifolds" in Luxemburg 2017, Workshop "International Workshop on Geometry, Dynamics and Anosov Representations" in Santigao (Chile) 2017.
- "Cauchy-compact flat singular spacetimes"; CIRM in Luminy (France) "Séminaire Commun d'Analyse Géométrique 2017".
- "Decorated Teichmüller space, polyhedral surfaces and spacetimes with BTZ";
  Places: Geometry seminar of Caltech and Luxembourg, Heidelberg, EPFL (Lausanne), Paris Rive-gauche, Monptellier, Avignon and Marseilles universities. Cycle of lectures "Paroles aux jeunes chercheur" in Strasbourg 2016 and 2017.
- "Constructions of polyhedral Cauchy-surfaces in singular spacetimes";

Computer skills

Contributor	Sagemath
Advanced	python,C++,Linux, LaTeX, Sagemath, Geogebra, Scilab/Matlab
Intermediate	html, javascript, Coq,Tensorflow/Keras
Basic	Visual Basic, Caml, PIC16 assembly language, LAMP

Languages

French	**Mother tongue**
English	**Advanced**
German	**Pre-intermediate**
Chinese	**Beginner**

Interests

- Piano
- Cooking
- Metal bands...
- Chess
- Poker