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# PhD in Biophysics

*PhD student from 01/09/2012 in the LPT & IPBS labs,  
CNRS (Toulouse-France), defense expected at the  
end of October*

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**Keywords : Single molecule approaches,  
Kinetic Monte-Carlo simulation, statistical  
physics, DNA dynamics, soft matter**

## SKILLS

Modeling	Microscopy
Approach : Dynamic Kinetic Monte-Carlo simulation	Techniques : STM, MEB, fluorescence and dark field microscopy
<b>Data analyses procedure</b>	Analysis : ImageJ
Developing an computing procedure to check the physical coherence (symmetry factor, correlation function) of gigaoctet of raws data and to applied first step of analyses	<b>Characterization technique</b>
<b>Informatics</b>	DLS, Zetasizer, UV spectroscopy, quantification PCR
Tools : Mathematica, Matlab, Labview, Scribus (PAO), Pymol, gnuplot, office tools	<b>Surface treatment process</b>
Languages : Fortran, C, R, LaTeX, Beamer, bash	Chemical treatment : epoxydation, thiolisation, piranha
Office tools: GIMP, Inkscape, Microsoft office and OpenOffice (type Word, Exel, Powerpoint)	Physical treatment : Plasma cleaner, UV ozone
Systems : Linux (Ubuntu), Windows	Method : spin coating, deposit convective self-assembly
	<b>Languages</b>
	English : TOEIC Score 775
	German : Conversational basics

## TRAINING AND DIPLOMA

2012-Now	<b>PhD in Physic (defense planned the October 16th 2015)</b> <b>Doctoral School : Matter of Science,</b> <b>Specialty : Physique</b> <b>Single molecule study of DNA molecules conformations with local defects or under a large set of physicochemical conditions</b> - Advisor : <b>Destainville N. (LPT) and Tardin C. (IPBS)</b> <ul style="list-style-type: none"> <li>Measure the impact of intrinsic bending, local denaturation or variation of ion concentration in solution on the DNA conformations with high-throughput Tethered Particle Motion (HT-TPM)</li> <li>Perform a kinetic Monte-Carlo Simulation based on a mesoscopic statistical model of DNA</li> <li>Develop a computational procedure for the analysis of the large data set from HT-TPM</li> </ul>	<b>University of Toulouse III (France)</b> <b>Laboratories LPT et IPBS, CNRS, Toulouse (France)</b>
2011-2012	<b>Master 2R, Specialty : Nanosciences, Nanomesures</b> <b>Master's training period in nanotechnologies (6 months)</b> <b>Formation of nano-energetic material made of Al/CuO alloy driven by DNA auto-assembly and chip integration</b> – Advisor : <b>Bancaud A. and Rossi C.</b> <ul style="list-style-type: none"> <li>Construct heterogeneous advances material structured on 1D, 2D or 3D-dimensions by using the complementarity of the double strand DNA, and optimize its stability and its energetic response</li> </ul>	<b>University of Toulouse III (France)</b> <b>LAAS-CNRS, Toulouse (France)</b>
2010-2011	<b>Master 1, Specialty : Fundamental Physic</b> <b>Master's training period in microscopy (2 months)</b> <b>Studies of the 2-(3-perylene) ethanoic acid molecular by Scanning Tunneling Microscopy (STM) at Low Temperature and Ultra High Vacuum</b> – Advisor : <b>Coratger R.</b> <ul style="list-style-type: none"> <li>Measure the value of the single negative charge appearing during the process</li> </ul>	<b>University of Toulouse III (France)</b> <b>CEMES-CNRS, Toulouse (France)</b>
2009-2010	<b>Licence 3, Specialty : Physics et Applications</b> <b>Training period at the Braley company</b> <b>Realization of a solar furnace coupled with a Stirling engine</b> <ul style="list-style-type: none"> <li>Realize the solar furnace and animate a stand on the energies at the open day of the company</li> </ul>	<b>University of Toulouse III (France)</b> <b>Braley Company, Bozouls (France)</b>

## SCIENTIFIC PUBLICATIONS

2015	<b>Brunet, A., Tardin, C., Salomé, L., Rousseau, P., Destainville, N., Manghi, M., Dependence of DNA persistence length on ionic strength of solutions with monovalent and divalent salts: a joint theory-experiment study, Macromolecule, DOI : 10.1021/acs.macromol.5b00735</b>
2015	<b>Brunet, A., Chevalier, S., Destainville, N., Manghi, M., Rousseau, P., Salhi, M., Salomé, L., Tardin, C., Probing a label-free local bend in DNA by single molecule tethered particle motion, Nucleic acids research, DOI : 10.1093/nar/gkv201</b>
In preparation	<b>Brunet, A., S., Destainville, N., Manghi, M., Rousseau, P., Salomé, L., Tardin, C., Dependence of DNA apparent length and persistence length on temperature of solutions, a joint theory-experiment study</b>

## CONGRESSES AND THEMATICS SCHOOLS

### Oral Communication

In coming, 8-9 Aout 2015  
November 2014  
January 2014  
May 2013

Gordon Research Seminars (GRS) : Soft Condensed Matter Physics - **New London (USA)**  
3<sup>rd</sup> meeting of FRBT – **Toulouse (France)**,  
Seminar IRSAMC – **Toulouse (France)**,  
3<sup>rd</sup> edition of the “Les Houches School” in computational physics: DNA, from molecules to evolution – **Les Houches (France)**

### Thematic School

August 2014  
May 2013

Summer school : SOFT-FIRE-2014 – **Cargèse (France)**, (2 weeks)  
3<sup>rd</sup> edition of the “Les Houches School” in computational physics: DNA, from molecules to evolution – **Les Houches (France)**, (2 weeks)

### Poster Communication

In coming, 9-14 Aout 2015  
August 2014  
May 2013  
May 2013

Gordon Research Conference (GRC) : Soft Condensed Matter Physics - **New London (USA)**  
Summer school : SOFT-FIRE-2014 – **Cargèse (France)**  
GDR Cell Tiss 2013 - **Lyon (France)**  
3<sup>rd</sup> edition of the “Les Houches School” in computational physics: DNA, from molecules to evolution – **Les Houches (France)**

## STUDENT SUPERVISION

**Master's training period :** Juliette Wilhem

**(2 months)**

Summer 2014 **Probing the experimental effect of the ionic strength on the DNA conformation release by TPM, at the single molecule level**

## REFERENCES

### Pr. Destainville Nicolas

Laboratoire de Physique Théorique ,  
Team : Physique Statistique des Systèmes Complexes  
Toulouse, France

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### Dr. Bancaud Aurélien

Laboratoire d'analyse et d'architecture des systèmes,  
Team : Nano Ingénierie et Intégration des Systèmes  
Toulouse, France

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### Dr. Tardin Catherine

Institut de Pharmacologie et de Biologie Structurale ,  
Team : Membrane and DNA dynamics  
Toulouse, France

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### Dr. Salomé Laurence

Institut de Pharmacologie et de Biologie Structurale ,  
Team : Membrane and DNA dynamics  
Toulouse, France

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**e-mail : [laurence.salome@ipbs.fr](mailto:laurence.salome@ipbs.fr)**

## OTHER ACTIVITIES AND INTERESTS

### Other professional experience :

2012 Technique staff at the Symposium J de l'E-MRS 2012 Spring Meeting - Strasbourg (France)

### Associative activities :

Since 2009 Co-founder and editor of the inter-university newspaper : *Le Lapin Blanc* – University of Toulouse I, II and III (France)

2007-2008 University of Toulouse III site organizer for the AMIDONS association – Association Inter- university for donation of blood – University of Toulouse III (France)

Since 2006 AMIDONS association volunteer - Toulouse (France)

2003 First aid qualification - *Attestation de Formation aux Premiers Secours* - Œuvre hospitalière française de l'ordre de Malte (France)

**Entertainment :** Reading (Polar, Heroic fantasy, Anticipation), climbing, volleyball, badminton, cinema, theater, rugby

Toulouse, 26<sup>th</sup> may 2015

**Subject : Applications of a research engineer position in computational imaging and super-resolution microscopy**

Dear Dr. Christophe Zimmer,

I am delighted to apply for a research engineer position in computational imaging and super-resolution microscopy

I am very interested by your project on the genome architecture and the dynamic of chromosome folding. If DNA is well-known for containing the genetic code essential to the cell physiology, its mechanical characteristics are now also under close study as they may actively participate to the different biological processes. Studying the spatial architecture and dynamics of the genomic material compose an important field of research to fully understand of genome conformation and function. To probe the role played by the statistical and mechanical properties of the chromosome in the nucleus, acquisition of experimental data with high-accuracy and resolution at high-throughput is needed in one hand. In the other hand, computational models become a crucial and decisive complement in order to make sense of the experimental data. I truly believe that combining computational model and experimental data will allow a better understanding of how chromosomes fold, move and interact.

Indeed during my PhD project (defense planned at the end of October 2015), I have studied at the single molecule level the conformational changes of DNA molecules caused by the presence of local defects on the molecule or changes in global physicochemical conditions. My work aims at both observing and modeling the physical mechanisms which regulate the rigidity of double-stranded DNA to improve the understanding and the theoretical description of soft matter. For that, I have performed in one hand experimental measurements at the single molecule level by using the techniques called Tethered Particle Motion (TPM) (IPBS, Toulouse) and on the other hand a Kinetic Monte Carlo simulations using an ad'hoc mesoscopic statistical model (LPT, Toulouse). I'm particularly interested by the biophysic field and sensitive to the complementarity of the combining of experimental, theoretical and computational approaches. During this interdisciplinary project, I have experienced the work with molecular biologists (LMGM, Toulouse), biophysicists and physicists teams and learned how to deal with such multidisciplinary approaches. Accustomed to use imaging methods and optical microscopy, I am aware and mindful of the experimental constraints and as well as the experimental limitations, and particular with single-molecule requirements. Furthermore, I stay turned to revise and develop possible improvements.

Moreover, the IPBS group, where I carried out my TPM measurements, has not only a recognized expertise in TPM techniques but they also developed a biochip that enables the high parallelization of TPM measurements resulting in the analysis of several hundred molecules simultaneously. On part of my job has consisted in coding and developing a robust and reliable procedure to analyses this large acquisition data sets. For this, I have established a computing procedure in Mathematica language to check the physical of gigaoctet of raws data and perform first step of analyses. Thanks to the ensuing high-throughput data acquisition and the analyses procedure, I have accumulated a large number of individual statistics that enabled me to reveal and characterize a local bend present in DNA and discriminate between different models of polymer physics that describe the salt effect on the DNA persistence length.

Participating in a project dealing with the biology, biophysics, physics and the computational biology of DNA, would perfectly fit with my will to continue in the condensed matter field at the frontier with biology. Besides, I am extremely eager to explore the conformations of the DNA in its native state such as it is organized in chromatin. As a result, I am strongly motivated to participating in a project which prospected the spatial architecture and dynamics of the genomic material in the nucleus and the implication in various aspects of gene expression, DNA repair, recombination, and replication. I believe that I have the computational and experimental skills, that match your requirements of your project and that this project offer me the opportunity to develop new ones.

Brunet Annaël

[czimmer@pasteur.fr](mailto:czimmer@pasteur.fr)

Dear Dr. Christophe Zimmer,

I am writing to you to apply for the position of a research engineer in computational imaging and super-resolution microscopy.

My current PhD (defense planned in the end of October 2015) let me to use both experimental and numerical approaches at the single molecule level. I acquired computational skills as I developed a program (Mathematica) for the fast and efficient analysis of large data sets and preformed simulations (.c) of DNA conformations based on statistical models. In addition, during this project I have successfully collaborate with multidisciplinary teams such as molecular biologists, biophysicists and physicists.

I am very interested by your project. I believe that my qualifications would match your requirements, and would offer me he opportunity to develop new ones.

Please find the details of my CV and cover letter as an attachment,

I am available for any further information that you would need.

Yours sincerely

Annaël Brunet