

**99TH ENCOUNTER BETWEEN MATHEMATICIANS AND  
PHYSICISTS  
GEOMETRY AND PHYSIC  
DEDICATED TO THE MEMORY OF W. P. THURSTON  
8–10 JUNE 2017, INSTITUT DE RECHERCHE MATHÉMATIQUE  
AVANCÉE**

ORGANIZERS:  
VINCENT ALBERGE (FORDHAM UNIVERSITY), KEN'ICHI OHSHIKA (OSAKA  
UNIVERSITY) AND ATHANASE PAPADOPOULOS (UNIVERSITÉ DE STRASBOURG)

PROGRAM

**Thursday, June 8th 2017.**

- 9:00 am  
**Norbert A'Campo** - Universität Basel  
Title: *TBA*  
Abstract: TBA
- 10:00 am  
**Coffee Break**
- 10:30 am  
**Louis Funar** - Université Grenoble Alpes  
Title: *Cantor surfaces and mapping class groups*  
Abstract: Smooth mapping class groups of compact surfaces punctured along Cantor sets have strong finiteness properties and they are closely related to Thompson groups. Similar constructions in higher dimensions can be used to recover Brin's finitely presented groups.
- 11:30 am  
**François Fillastre** - Université de Cergy-Pontoise  
Title: *On the space of flat metrics with conical singularities on a compact surface*  
Abstract: By a result of W. P. Thurston, the moduli space of flat metrics on the sphere with prescribed  $n$  cone singularities of positive curvature is a complex hyperbolic orbifold of dimension  $n - 3$ . The Hermitian form comes from the area of the metric. Using geometry of Euclidean polyhedra, we observe that this space has a natural decomposition into real hyperbolic convex polyhedra of dimensions  $n - 3$  and  $\leq 1/2(n - 1)$ . By a result of W. Veitch, the moduli space of flat metrics on a compact surface with prescribed cone singularities of negative curvature has a foliation whose leaves have a local structure of complex pseudo-spheres, coming again from the area of the metric. The form can be degenerate; its signature depends on the collection of angles. Using polyhedral surfaces in Minkowski space, we show

that this moduli space has a natural decomposition into spherical convex polyhedra.

- 2:00 pm  
**Shinobu Hosono** - Gakushuin University  
 Title: *Mirror symmetry and birational geometry of CICYs*  
 Abstract: After making a quick survey of the “classical” mirror symmetry in 90’s, I will discuss two interesting examples of complete intersection Calabi-Yau manifolds (CICYs) which have birational automorphisms of infinite order. I will describe the mirror symmetry (mirror family) of these Calabi-Yau manifolds, and observe that the birational automorphisms correspond nicely to certain monodromy transformations of the family. If time permit, I will show “Picard-Lefschetz monodromy” which corresponds to flopping curves. This talk is based on collaborations with Hiromichi Takagi.
- 3:00 pm  
**Coffee Break**
- 3:30 pm  
**Hideki Miyachi** - Osaka University  
 Title: *Towards complex analysis on Teichmüller space with Thurston’s theory*  
 Abstract: TBA.
- 7:30 pm  
**Conference dinner** - [Restaurant le Petit Bois Vert](#)

#### Friday, June 9th 2017.

- 9:00 pm  
**Valerii Berestovskii** - Novosibirsk State University  
 Title: *On curvatures of homogeneous sub-Riemannian manifolds*  
 Abstract: In the last years there arose an interest in definitions and calculations of sectional and Ricci curvatures of sub-Riemannian manifolds. For examples, one can mention recent papers of Agrachev-Barilari-Rizzi, Baudoin-Garofalo, Sturm, and others. I will discuss briefly some classical work papers connected with this subject by Schouten, Wagner, and especially a later paper by A.F.Solov’ev (1984) for rigged metrized distributions on Riemannian manifolds. To apply results of these papers, the author suggests to use in some cases special riggings of corresponding invariant bracket generated distributions on homogeneous sub-Riemannian manifolds. In particular, this method works for contact sub-Riemannian manifolds, sub-Riemannian Carnot groups, for horizontal distribution of natural submersion of full connected semisimple isometry group of Riemannian symmetric space onto this space.
- 10:00 am  
**Coffee Break**
- 10:30 am  
**Daniele Alessandrini** - Universität Heidelberg  
 Title: *Geometric Structures with Quasi-Hitchin Holonomy*  
 Abstract: I will describe some manifolds admitting parabolic geometric structures whose holonomy is a Hitchin or a Quasi-Hitchin representation. This generalizes the Thurston’s theories of Fuchsian and Quasi-Fuchsian

representations to higher rank Lie groups. The results come from a joint work with Qiongling Li and a joint work with Sara Maloni and Anna Wienhard.

- 11:30 am

**Mahmoud Zeinalian** - The City University of New York

Title: *On some symplectic aspects of moduli stack of Chen connections*

Abstract: The study of the Poisson geometry of the Teichmüller space and the moduli space of local systems gave rise to the discovery of the Goldman bracket of curves on an oriented surface which in turn led Chas and Sullivan to discover string topology operations on chains on the free loop space of an arbitrary oriented manifold. Their string topology operations also generalized the Turaev cobracket which did not come from a Poisson geometric origin, and the search for the geometric meaning of all string topology operations continues. In this direction, I will discuss some Poisson geometric aspects of the moduli stack of  $Z$ -graded Chen connections and how in the large  $N$ -limit an additional relevant structure should appear ( $N$ =dimension of the fibre). Unlike the  $Z$ -graded case, the somewhat conceptually different  $Z/2$  graded case, studied several years ago with Hossein Abbaspour, did not require the use of derived geometry. The simple reason is that there are very few maps (e.g. traces) from a  $Z$ -graded object to a ground ring concentrated in degree zero, whereas in the  $Z/2$  graded setting, viable maps exist. In the derived setting the single ground ring is replaced by the class of all non-positively graded differential graded algebras, with the differential going up towards the origin, as the test objects (i.e. a deformation functor). I plan to review the necessary background material before discussing recent work. This is part of a joint work in progress with Gregory Ginot and Owen Gwilliam.

- 2:00 pm

**Francesco Bonsante** - Università degli Studi di Pavia

Title: *The volume of the convex core of globally hyperbolic AdS space-times*

Abstract: Globally hyperbolic AdS space-times are Lorentzian manifolds of constant curvature  $-1$  with topological support the product of a surface and the real line. Once the genus of the surface is fixed, Mess showed that the relevant moduli space is the product of two copies of the Teichmüller space of the corresponding surface. In analogy with the quasi-Fuchsian case those Lorentzian manifolds contain a convex core. In the talk, after briefly revising the theory of GH AdS space-times, I will determine the coarse behavior of the volume of the convex core in terms of the  $L^1$ -energy between the two hyperbolic metrics associated to the space-time by Mess. This is a joint work with A. Seppi and A. Tamburelli.

- 3:00 pm

**Coffee Break**

- 3:30 pm

**Rinat Kashaev** - Université de Genève

Title: *TBA*

Abstract: *TBA*.

- 4:30 pm

**Georgios Daskalopoulos** - Brown University

Title: *Rigidity of Group Actions on NPC Spaces*

Abstract: The goal of this talk is to describe two different approaches of using harmonic maps into metric spaces of non-positive curvature in the sense of Alexandrov to prove rigidity.

- 6:00 pm  
**Reception - Strasbourg City Hall**

**Saturday, June 10th 2017.**

- 9:00 am  
**Richard Wentworth** - University of Maryland  
Title: *Higgs bundles and pleated surfaces*  
Abstract: In this talk I will revisit the asymptotic structure of the  $SL(2, \mathbb{C})$  character variety of a closed surface group. Recent work of Taubes and Mazzeo, et.al. describes the large scale behavior of solutions to the Hitchin equations in terms of certain limiting configurations. I will show how these correspond, via harmonic maps, exactly to Bonahon's parametrization of pleated surfaces in hyperbolic 3-space by transverse and bending cocycles for a geodesic lamination. This is joint work with Andreas Ott, Jan Swoboda, and Mike Wolf.
- 10:00 am  
**Coffee Break**
- 10:30 am  
**Gael Meigniez** - Université Bretagne-Sud  
Title: *Thurston's Foliation Theorem in codimension 1, old and new*  
Abstract: In 1976, W. Thurston published two forms of the h-principle for foliations of codimension 1, on closed manifolds of all dimensions. I shall recall his methods and give some more recent improvements in ambient dimension at least 4, avoiding the use of Mather's homology equivalence in the proof, and obtaining foliations with all leaves dense.
- 11:30 am  
**Sumio Yamada** - Gakushuin University  
Title: *Harmonic map construction of 4+1 spacetimes with non-spherical blackholes*  
Abstract: Based on a collaborative project with Marcus Khuri and Gilbert Weinstein, we construct solutions to the 4 + 1 dimensional vacuum Einstein equation. We impose stationarity and two axisymmetries of the spacetime which would reduce the Einstein equation to a semi-linear elliptic system, which in turn is identified with the harmonic map equation into a symmetric space. In this construction, we obtain a whole new set of the solutions to the Einstein equation whose blackhole horizons have the entire range of topological types appearing as the irreducible elements in the prime decomposition theorem of three dimensional manifolds.
- 12:30  
**Conference Closing Drink**