

“Exceptional and ubiquitous Painlevé equations for Physics.”

Mathematics-Physics workshop / LPT-ENS Summer Institute 2017

The miniworkshop from August 16th to August 18th will gather mathematicians and physicists to discuss the geometrical approach to Painlevé differential and difference equations. In particular the occurrence of discrete groups of symmetries related to the exceptional Lie group E_8 and connections to nonlinear integrable systems will be addressed. Solutions of Painlevé equations have appeared in many places over the years, recently they have been encountered in supersymmetric gauge theories and in topological string theory, various dualities will be explained and exploited. A number of presentations will be introductory others will cover recent quantization, deformation and discretization issues. Exchanges will continue during the following week of the LPTENS Summer Institute.

SCHEDULE

	Morning	Afternoon
Wednesday August 16 th		2-3:30 PM Loray (Review) 4-5 PM Ruijsenaars (Review)
Thursday August 17 th	9:30-10:30 AM Lisovyi 11-12 AM Saito	2-3 PM Tanzini 3:30-5 PM Yamada (Review)
Friday August 18 th	9:30-10:30 AM Costin 11-12 AM Casale	2-3 PM Grassi 3:30-4:30 PM Ruijsenaars

TITLES AND ABSTRACTS

1 Frank Loray Université de Rennes 1

"Isomonodromic deformations and Painlevé equations" (90 min.)
Abstract: We introduce the notion of isomonodromic deformations of linear systems on the Riemann sphere, and explain how Painlevé equations can be derived from them. Although we will mainly talk about the Painlevé VI case, related to fuchsian systems, we will explain how other Painlevé equations arise. We will deduce the Painlevé property from the Riemann-Hilbert correspondence. We will give a geometric description of the space of initial conditions, its symmetries, and how singularities arise.

2 Simon Ruijsenaars I University of Leeds

« Integrable systems of Calogero-Moser type »

3 Oleg Lisovyi Université de Tours

« Connections between Painlevé tau functions and Nekrasov representation of the dual instanton partition functions »

4 Masa-Hiko Saito University of Kobe

“Moduli spaces of connections and Higgs bundles over curves and Geometric Theory of equations of Painlevé type.”

5 Alessandro Tanzini Sissa Trieste

“Painlevé / gauge theory correspondence”

6 Yasuhiko Yamada University of Kobe

« Geometric aspects of discrete Painlevé equations » (90 min.)

7 Ovidiu Costin Ohio State University

« Asymptotic methods for the analysis of Painlevé equations »

Abstract : We present new resurgence based methods for the global analysis of problems in mathematics, and models in physics such as QFT and string theory. The starting point can simply be a perturbative expansion. This approach is particularly well suited for finding the "large-to-small coupling" connection and for calculating the monodromy at infinity. Applied to the Painlevé P1 equation, the Stokes constant is obtained in closed form simply from the Painlevé property (all movable singularities are poles); the small argument behavior of the tritronquée solution is derived from its asymptotic behavior, a crucial ingredient we used for proving of Dubrovin's conjecture. We devise convergent rational function expansions for the tritronquée which are practical, efficient and accurate throughout its domain of analyticity sought by the Painlevé program initiated by Deift & al.

Work with G. Dunne, M. Huang and S. Tanveer

8 Guy Casale Université de Rennes 1

« Painlevé equations and differential Galois theories »

9 Alba Grassi ICTP Trieste

“Topological String, Spectral Theory and Painlevé equations”

10 Simon Ruijsenaars II

« Relativistic Heun equation and E_8 spectral invariance. »