

# ANNALES DE LA FACULTÉ DES SCIENCES DE TOULOUSE Mathématiques

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*KAWA Lecture Notes*

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## KAWA Lecture notes

This volume collects lecture notes of some of the mini-courses delivered during the first four editions of KAWA,

Komplex Analysis Winterschool/Workshop and Applications.

### Why KAWA?

**Several Complex Variables in the 21st century.** Complex analysis in several variables (usually abbreviated as SCV) went through a golden age during the second half of the 20th century. These last few years, what used to be the core of SCV saw most activity gradually desert it, to move to the interface with other subfields. Complex analysis methods thus proved decisive in recent developments for (direct and) inverse problems in the spectral theory of self-adjoint differential operators, in probability theory (Schramm-Loewner evolution equation), in signal processing (Gabor analysis), in random matrix theory, in conformal field theory, in the statistical analysis of critical two-dimensional networks.

Moving in a different direction, the ergodic theory of rational maps is a very rich and vigorously expanding field. It is using many tools from, and motivates many new questions in complex analysis and complex geometry. One may mention, too, the recent and fruitful interaction between pluripotential theory and differential and Kählerian geometry, as well as the – ever stronger – interaction between complex analysis and analytic and algebraic geometry.

In order to pass on the knowledge accumulated along the last few decades by complex analysis, as well as to acquaint young and confirmed investigators with the methods of those domains where new interactions take place, researchers from Toulouse and Barcelona with a well-established track record of cooperation (within the Journées Complexes du Sud) have started a yearly thematic event:

**KAWA, Komplex Analysis Winterschool/Workshop.** A yearly meeting made up of a week of mini-courses followed by a workshop (short con-

ference) with a stable location. The mini-courses being held in Toulouse, Marseille or Barcelona, the workshop in the same place or in a neighboring town. A short list of the main topics covered is:

- One and several variable complex dynamics
- Analytic, differential and almost complex geometry
- New developments in function and operator theory
- Pluripotential theory and applications

This project is meant to last. Once in a while, a larger conference, of European scope, will be planned (the first of those will take place in 2014 at CIRM, in Marseille).

**Organizing committee.** The organizers of these first editions were

- Vincent GUEDJ, Université Paul Sabatier (FRANCE),
- Jordi MARZO<sup>1</sup>, Universitat de Barcelona (ESPAGNE),
- Joaquim ORTEGA-CERDÀ, Universitat de Barcelona (ESPAGNE),
- Pascal THOMAS, Université Paul Sabatier (FRANCE),

**Scientific committee.** The scientific committee of KAWA consisted of:

- Bo BERNDTSSON, University of Gothenburg (SWEDEN);
- Jean-Pierre DEMAILLY, Université J. Fourier (FRANCE);
- Julien DUVAL, Université Paris 11 (FRANCE);
- Franc FORSTNERIČ, Ljubljana University (SLOVENIA);
- Laszlo LEMPert, Purdue University (USA).

## Courses

This volume consists of sets of lecture notes of those courses given at KAWA which were not already the object of a published article or survey. Here follows a list of all the courses delivered (five hours each):

**KAWA 1.** [Toulouse & Albi, 25-29.01.2010]

1. Sébastien BOUCKSOM (Université Paris 7, France): **Transfinite diameter and equilibrium measures on complex manifolds.**  
See Berman, R., Boucksom, S., Witt Nyström, D., *Fekete points and convergence towards equilibrium measures on complex manifolds*, Acta Math. **207** (2011), no. 1, 1–27.

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<sup>(1)</sup> Starting with KAWA 3.

2. Misha LYUBICH (Stony Brook University, USA):  
**Lee-Yang zeros and 2D rational dynamics.**  
See <http://www.math.sunysb.edu/~mlyubich/papers/index.html>
3. Alexandre SUKHOV (Université de Lille, France):  
**Complex methods in symplectic topology.**
4. Dror VAROLIN (Stony Brook University, USA):  
**Bergman Kernels in Complex Analytic Geometry.**  
See <http://arxiv.org/abs/math/0511225>

**KAWA 2.** [CIRM, 31.01-05.02.2011]

1. Bo BERNDTSSON (CTH, Sweden):  
**Kähler Geometry and convexity.**
2. Charles FAVRE (Ecole Polytechnique, France):  
**The Cremona group.**  
See : Favre, C., *Le groupe de Cremona et ses sous-groupes de type fini*, Séminaire Bourbaki. Astérisque 332 (2010), Exp. 998, 11-43.
3. Kristian SEIP (NTNU, Trondheim, Norway): **Hardy spaces of Dirichlet series and function theory on polydiscs**  
See <http://arxiv.org/abs/1206.2815>

**KAWA 3.** [Barcelona, 30.01-04.02.2012]

1. Romain DUJARDIN (Ecole Polytechnique, France).  
**Parameter spaces of holomorphic dynamical systems.**  
See Dujardin, R. *Bifurcation currents and equidistribution in parameter space*. To appear in *Frontiers in complex dynamics* (celebrating John Milnor's 80th birthday).
2. Steve ZELDITCH (Northwestern University, USA).  
**Planck's constant in stochastic complex geometry.**  
See <http://euclides.imub.ub.es/kawa12/papers/Zelditch.pdf>
3. Ahmed ZERIAHI (IMT, France). **A viscosity approach to degenerate complex Monge-Ampère equations.**

**KAWA 4.** [Toulouse & Albi, 21-27.01.2013]

1. Kari ASTALA (Helsinki University, Finland), **Holomorphic deformations in calculus of variations and geometry.**  
See Astala, K., Iwaniec, T., Prause, I., Saksman, E., *Burkholder integrals, Morrey's problem and quasiconformal mappings*, J. Amer. Math. Soc. **25** (2012), no. 2, 507-531.

2. Robert BERMAN (CTH, Sweden), **Real Monge-Ampère equations and Kähler-Einstein metrics on toric varieties.**
3. Franc FORSTNERIČ (Ljubljana University, Slovenia)  
**Oka manifolds.**

### Acknowledgements

First of all, the continued existence of the KAWA series wouldn't have been possible without the participation of dozens of people from all around the world (from 60 to 100 for each edition), and we the organizers are thankful for the trust they put in us. Also, thanks are due to the advisors at various universities who encouraged their students to go and found them funding. We also have to thank all those who gave talks, and all the others who offered to do so, but couldn't be included in our programme, severely constrained by time; and the scientific committee who helped and guided us through the difficult process of selecting which talks would be given.

We are thankful, too, for the financial support from various sources which enabled us to subsidize, in particular, part of the expenses of most of the younger participants in the various editions of KAWA:

Our institutions, the Institut de Mathématiques de Toulouse, the Université Paul Sabatier, the Universitat de Barcelona; the Institut de Matemàtica de la Universitat de Barcelona (IMUB), the Agence Nationale de la Recherche (through its MACK programme), the Institut Universitaire de France, the CNRS, the CIRM, the CTP (Communauté de Travail des Pyrénées), the Région Midi-Pyrénées, the Département of Tarn.

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