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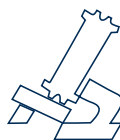
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Israel Mathematical Conference Proceedings

Complex Analysis and Dynamical Systems VI
Part 2: Complex Analysis, Quasiconformal Mappings,
Complex Dynamics

Sixth International Conference on
Complex Analysis and Dynamical Systems
in Honor of David Shoikhet on the Occasion of His Sixtieth Birthday
May 19–24, 2013
Nahariya, Israel

Mark L. Agranovsky
Matania Ben-Artzi
Greg Galloway
Lavi Karp
Dmitry Khavinson
Simeon Reich
Gilbert Weinstein
Lawrence Zalcman
Editors



American Mathematical Society
Providence, Rhode Island

Bar-Ilan University
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Avi Hirschfield Photography

David Shoikhet

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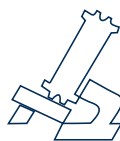
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Preface

The Sixth International Conference on Complex Analysis and Dynamical Systems (CA&DS VI), sponsored by ORT Braude College (Karmiel, Israel), Bar-Ilan University (Ramat-Gan, Israel) and the University of Miami (Miami, FL, USA), took place at the Carlton Hotel, Nahariya, Israel, during May 19-24, 2013. The conference was devoted to the interaction between various branches of Mathematical Analysis and was organized into three main parallel sessions: Complex Analysis, Partial Differential Equations and General Relativity. Altogether, 154 participants from 21 countries attended the Conference, which was held in honor of Professor David Shoikhet's sixtieth birthday. The Conference was held in conjunction with the ISF (Israel Science Foundation) Workshop on Integral Transforms and Spectral Theory in Analysis and Geometry.

These proceedings, which comprise two volumes, are the tangible record of the Conference. Most of the papers collected here have been contributed by participants in the Conference. In some cases, they have chosen to submit manuscripts which depart from the texts of their lectures. Several invited speakers who were unable to attend the Conference also contributed papers to these proceedings. All submissions have been carefully refereed. The papers in this second volume are mainly devoted to Complex Analysis, Quasiconformal Mappings, and Complex Dynamics while the papers in the first volume deal with Partial Differential Equations, Differential Geometry, and the Radon Transform. They testify to the continued vitality of the interplay between classical and modern analysis.

We acknowledge with thanks the support provided for the Conference by the US National Science Foundation, the Galilee Research Center for Applied Mathematics of ORT Braude College, the University of Miami, the Gelbart Research Institute for Mathematical Sciences of Bar-Ilan University, the Emmy Noether Research Institute for Mathematics of Bar-Ilan University, and ISAAC—International Society for Analysis, its Applications and Computations. Finally, we thank Miriam Beller, who (as in previous volumes) served as Technical Editor.

The Editors

David Shoikhet at Sixty

Mark Agranovsky, Mark Elin, and Lawrence Zalcman

David Shoikhet was born on April 26, 1953 in Odessa and attended the public schools in that city. In 1970, having completed his secondary education at a school specializing in mathematics and physics, David entered Krasnoyarsk State University (KSU), where just a few years earlier, Lev Aizenberg had founded the Department of Mathematical Analysis. In 1976, he graduated KSU with an M.Sc. thesis entitled “On Univalent Functions in Complex Spaces,” written under the supervision of A.P. Yuzhakov.

For the next fourteen years, David held simultaneously a teaching position in the Department of Higher Mathematics at the Krasnoyarsk Institute of Non-Ferrous Metals (KINM) and a research position at the Institute of Physics of the Siberian Branch of the Academy of Sciences of the USSR, from which he received his Ph.D. in 1983, with a thesis entitled “On the Solvability of Operator Equations with Analytic Non-linearities,” written under the direction of Yuzhakov and Victor Khatskevich. At KINM, he was promoted to the rank of Senior Lecturer in 1983 and to Associate Professor in 1985, and at the Institute of Physics to Senior Research Fellow in 1985 and Senior Research Associate in 1988.

In 1990, the Shoikhets moved to Israel. Shortly thereafter, David joined the faculty of the recently established ORT Braude College in Karmiel. From the very beginning, David took the lead in raising the academic level of the nascent institution, founding the Department of Mathematics and serving as its first Chairman from 1992 to 2008. During this period, he played a pivotal role in the development of new courses and syllabi and the recruitment of strong researchers to the Department. At the same time, he became actively associated with the Technion, first as an Adjunct Senior Teaching Associate (1991-1996) and then as an Adjunct Professor (1996-2008) and Visiting Professor (1999-2003). In 2002, David became the first regular faculty member to be promoted to the rank of (Full) Professor at ORT Braude; and in 2008, he was appointed Vice President for Academic Affairs at ORT Braude, a position he filled with great distinction until 2014.

Shoikhet’s research, contained in over a hundred published papers and five research monographs, focusses on the interaction of nonlinear analysis and complex analysis, dynamical systems and operator theory. In view of its sheer volume, a detailed account of this work is obviously out of the question. Accordingly, we content ourselves with simply mentioning a few of the high points.

Together with his long-time collaborators, Victor Khatskevich and Simeon Reich, David initiated the systematic study and development of the theory of nonlinear semigroups of holomorphic mappings in infinite dimensional Banach

spaces [32], [34], [35], [36], [41].¹ A lucky idea was to synthesize tools of infinite dimensional holomorphy and hyperbolic geometry with the spectral theory of linear operators. In particular, Reich and Shoikhet showed [41] the differentiability (with respect to the parameter t) of a uniformly continuous semigroup $\{F_t\}_{t \geq 0}$ of holomorphic self-mappings of a domain D in a complex Banach space. It follows that the infinitesimal generator f , defined by

$$f(x) = \lim_{t \rightarrow \infty} \frac{x - F_t(x)}{t},$$

exists and is a holomorphic semi-complete vector field in D . This extends finite-dimensional results of Berkson-Porta [BP] and Abate [A] (which used compactness arguments unavailable in the infinite dimensional context), as well as the classical results on linear operators due to Hille and Dunford.

In their pioneering work on the generation theory of semigroups of holomorphic mappings, Shoikhet & Co. proved the following striking result, which can be viewed as a Global Implicit Function Theorem: *Let D be a bounded convex domain in a reflexive Banach space X , and let Δ be the open unit ball in a Banach space Y . Suppose that $F : \Delta \times D \rightarrow D$ is holomorphic and for some $\lambda_0 \in \Delta$ there is a fixed point $x_0 \in D$ of $F(\lambda_0, \cdot)$, i.e., $x_0 = F(\lambda_0, x_0)$. Then there is a holomorphic function $x(= x(\lambda)) : \Delta \rightarrow D$ such that $x(\lambda) = F(\lambda, x(\lambda))$ with $x(\lambda_0) = x_0$. Moreover, for each $\lambda \in \Delta$, the set of fixed points of $F(\lambda, \cdot)$ is a holomorphic retract (complex analytic submanifold) of D tangent to $\text{Ker}(I - D_x F(\lambda_0, x_0))$. In particular, if x_0 is an isolated fixed point of $F(\lambda_0, \cdot)$, then it is unique, and for each $\lambda \in \Delta$ there is a unique fixed point $z(= z(\lambda)) \in D$ of $F(\lambda, \cdot)$.* This was first proved by Khatskevich and Shoikhet [21] for Hilbert spaces, using the Poincaré hyperbolic metric, and was then generalized by Khatskevich, Reich and Shoikhet [29] to reflexive Banach spaces, following a remark of Henri Cartan. In fact, they formulated and proved it in a more general setting for null points of semi-complete vector fields.

Another notable result, due to L.A. Harris, Reich and Shoikhet [47], is the following extension of the Earle-Hamilton fixed point theorem [EH], as well as previous results of Khatskevich and Shoikhet: *If the numerical range of a holomorphic mapping of a bounded convex domain in a (complex) Banach space lies strictly inside the half-plane $\{z : \text{Re } z < 1\}$, then the mapping has a unique fixed point.*

More recently, David has also obtained [95] a boundary version of the Earle-Hamilton theorem for the Hilbert ball: *If $F : \mathbb{B} \rightarrow \mathbb{B}$ is a fixed point free mapping of the open unit ball \mathbb{B} in (complex) Hilbert space such that $F(\mathbb{B})$ is contained in a horosphere in \mathbb{B} , then the iterates F^n converge to a boundary point of \mathbb{B} .*

Shoikhet's research employs a contemporary vision of functional analysis and differential equations together with hyperbolic geometry. It illustrates how a deep understanding of the use of semigroup theory may lead to new results even in the one-dimensional case. Here we may cite his contributions to geometric function theory, including the study of starlike and spirallike functions with respect to a boundary point. Perhaps the most interesting result in this direction establishes a one-to-one correspondence between wedges contained in the image of a starlike function, backward flow invariant domains for the associated semigroup, and boundary null points of the semigroup generator [76].

¹Numbered references refer to the papers listed under the rubric "Papers" in the comprehensive bibliography of his publications contained in this volume. All other references are to the bibliography at the end of this article.

David's contributions to the teaching and the communication of mathematics have been no less distinguished than his research. In Russia, he was twice (in 1986 and 1988) a winner in the national competition for Excellence in Teaching and Research run by the Ministry of Higher Education; and in Israel, he received an award for Excellence in Teaching from the Technion in 1997. Testifying to his extraordinary gift for envisioning the possible combined with organizational skills of a very high order is the creation of the Galilee Research Center for Applied Mathematics at ORT Braude. Founded by David in 2005, it has supported an amazingly rich and varied program of visitors, collaborations and conferences on what can only be described as a shoestring budget. But the jewel in the crown of David's accomplishments in this area is surely the brilliant series of international conferences on Complex Analysis and Dynamical Systems, which have taken place (almost) every other year since 2001 and have done much to cement Israel's role as an important center of research in complex analysis.

Nor has David's unusual combination of creativity and organizational talent been limited to mathematics. He is surely one of the very few serious research mathematicians to have had a successful career in . . . show business! Having studied music from early childhood, he plays the piano, accordion, clarinet and guitar. For a time, this hobby actually became a kind of second profession for him, parallel to mathematics. In the 1970's, David worked evenings as a musician in a musical theater, where he met his wife Tania, who was employed as a singer there. Together, they decided to create their own "Theater of Song." The group of singers, dancers and actors they brought together gained rapid popularity in the USSR and participated in a number of international festivals in Eastern Europe (Bulgaria, Czechoslovakia, East Germany, Poland, Yugoslavia and Romania), Georgia, and Mexico. David himself wrote 13 musical scenarios for the Theater and 19 musical programs for television and received several awards and prizes as Artistic Director of the Theater of Song. He considers his most important accomplishment in this area his jazz-rock opera "Intermezzo in 1943," based on the book *Notes from the Gallows*, by the Czech journalist and anti-Nazi resistance leader Julius Fučík, for which he received a medal from the Ministry of Sciences and Culture of Czechoslovakia in 1989.

David and his lovely wife Tania, who continues her flourishing career as a singer and entertainer with appearances throughout Israel, live in the seaside community of Nahariya, as do their son Ofer and two granddaughters. Nahariya is, once again, the venue for the conference Complex Analysis and Dynamical Systems VII (May 10-15, 2015). Just two weeks later, the date June 1, 2015 marks the Silver Anniversary (25 years) of the Shoikhets' arrival in Israel. And so, along with wishing David a Happy Birthday, we take this opportunity also to wish the Shoikhets a Happy Anniversary.

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Conference Program

May 19 – May 24, 2011

Sunday - May 19, 2013

15:00 - 16:45 Informal mathematical discussions

17:15 - 19:00 Informal mathematical discussions

Monday - May 20, 2013

10:50 - 11:35 Plenary Lecture 1

P. Kuchment, *The nodal count mystery*

Morning Session 1: Integral Transforms and Spectral Theory

12:00 - 12:45 A. Iosevich, *Intersections of sets, group actions and Erdős-Falconer problems*

Morning Session 2: Complex Analysis

12:00 - 12:30 G. Gentili, *Regular functions of a quaternionic variable and polynomials orthogonal complex structures*

12:30 - 13:00 C. de Fabritiis, *H^p spaces of s -regular functions*

Morning Session 3: Partial Differential Equations

12:00 - 12:30 S. Gindikin, *Complex analysis and separation of spectrums for ultrahyperbolic differential operators*

12:30 - 13:00 M. Ruzhansky, *Quantization on Lie groups*

Morning Session 4: Geometric Function Theory

12:00 - 12:30 D. Aharonov, *A univalence criterion and its application to the error function*

12:30 - 13:00 V. Dubinin, *A new version of circular symmetrization with applications to the geometric function theory*

14:30 - 15:15 Plenary Lecture 2

M. Abate, *Wolff-Denjoy theorems in non-smooth convex domains*

15:20 - 16:05 Plenary Lecture 3

M. Sugimoto, *Recent progress in smoothing estimates for Schrödinger equations*

Afternoon Session 1: Integral Transforms and Spectral Theory

16:30 - 17:00 A. Montes-Rodriguez, *The Hilbert transform, Perron-Frobenius operators and the Klein-Gordon equation*

17:00 - 17:30 G. Ambartsoumian, *Reconstructing a function from its V -line averages in a disc*

17:40 - 18:10 L. Kunyansky, *Photo- and thermo-acoustic tomography in the presence of reflecting boundaries*

18:10 - 18:40 B. Rubin, *Weighted norm inequalities for Radon transforms*

Afternoon Session 2: Complex Analysis

- 16:30 - 17:00 V. Katsnelson, *Stieltjes function and Hurwitz stable entire functions*
 17:00 - 17:30 G. Kresin, *Sharp real-part theorems for derivatives of analytic functions*
 17:40 - 18:10 S. Kanas, *Generalized typically-real functions*
 18:10 - 18:40 D. Lubinsky, *Extremal problems for polynomials generate extremal problems for Paley-Wiener space*

Afternoon Session 3: Partial Differential Equations

- 16:30 - 17:00 J. Ben-Artzi, *Linear instability of the relativistic Vlasov-Maxwell system*
 17:00 - 17:30 A. Faminskii, *On large time decay of solutions to equations of Korteweg-de Vries type*
 17:40 - 18:10 J. Delgado, *Schatten classes and r -nuclearity on compact Lie groups*

Afternoon Session 4: Geometric Function Theory

- 16:30 - 17:00 D. Bshouty, *Affine modulus and Nitsche type problem*
 17:00 - 17:30 K. Dyakonov, *A reverse Schwarz-Pick inequality*
 17:40 - 18:10 A. Golberg, *Singularities of mappings with integrally bounded distortions*
 18:10 - 18:40 E. Sevostyanov, *On injectivity radius of local ring Q -homeomorphisms*

Tuesday - May 21, 2013

09:00 - 09:50 Plenary Lecture 4

A. Olevskii, *High-dim sampling and interpolation*

09:50 - 10:35 Plenary Lecture 5

I. Mitrea, *Harmonic analytic and geometric measure theoretic methods in several complex variables*

Morning Session 1: Integral Transforms and Spectral Theory

Chairman: A. Iosevich

11:05 - 11:50 A. Koldobsky, *Stability and separation in volume comparison problems*

12:15 - 12:45 A. Tumanov, *Minimizing discrete energy on the sphere*

12:45 - 13:15 D. Ryabogin, *On the continual Rubik's cube*

Afternoon Session 1: Integral Transforms and Spectral Theory

Chairman: F. Gonzalez

14:45 - 15:15 A. Sergeev, *Quantization of universal Teichmüller space*

15:15 - 15:45 F. Gonzalez, *Multitemporal wave equations and mean value operators*

16:00 - 16:30 N. Zobin, *Quantization of Whitney problems*

16:30 - 17:00 S. Tikhonov, *Wiener type theorems on Fourier series with positive coefficients*

17:30 - 18:00 E. Liflyand, *Fourier transform versus Hilbert transform*

18:00 - 18:30 Y. Salman, *Global extendibility phenomenon for the Euler-Poisson-Darboux Equation*

Morning Session 2: Analysis and Dynamics in Banach Spaces

Chairman: M. Abate

11:05 - 11:35 L.A. Harris, *Lagrange polynomials, reproducing kernels and Markov's polynomial inequality*

11:35 - 12:05 T. Kuczumow, *The common fixed point set of commuting holomorphic mappings in Cartesian products of Banach spaces*

- 12:15 - 12:45 P. Mellon, *Jordan Theory and Holomorphic Dynamics*
 12:45 - 13:15 M. Budzyńska, *The Denjoy-Wolff Theorem in complex Banach spaces*
Afternoon Session 2: Complex Analysis and Applied Dynamics
 Chairman: P. Mellon
- 14:45 - 15:15 F. Bracci, *The Julia-Wolff-Carathéodory theorem(s) in higher dimensions for mappings and infinitesimal generators*
 15:15 - 15:45 A. Isaev, *Explicit reconstruction of homogeneous isolated hypersurface singularities from their Milnor algebras*
 Chairman: G. Gentili
- 16:00 - 16:30 J. Kozicki, *Stochastic dynamics of a continuum particle system with dispersal and competition: micro- and meso-scopic description*
 16:30 - 17:00 Y. Gliklikh, *Dynamical systems with stochastic perturbations in terms of mean derivatives*
 17:30 - 18:00 V. Golubyatnikov, *Non-uniqueness of cycles in some simple non linear dynamical systems*
Morning Session 3: Partial Differential Equations
 Chairman: M. Ruzhansky
- 11:05 - 11:35 A. Shishkov, *Localization of singularities of solutions to semi-linear parabolic and elliptic equations with degenerate absorption potential*
 11:35 - 12:05 M. Gobbino, *Optimal decay estimates for semi-linear parabolic and hyperbolic equations*
 12:15 - 12:45 S. Lucente, *Nonlinear wave equations with variable coefficients*
 12:45 - 13:15 M. D'Abbicco, *Effectiveness of a scale-invariant damping for semilinear waves*
Afternoon Session 3: Partial Differential Equations
 Chairman: A. Faminskii
- 14:45 - 15:15 M. Ghisi, *The singular perturbation problem for Kirchhoff equation: sharp decay-error estimates*
 15:15 - 15:45 E. Malinnikova, *Logarithmic convexity for discrete harmonic functions*
 16:00 - 16:30 G. Tagliatela, *Weakly hyperbolic equations with nonanalytic coefficients*
Morning Session 4: Functional and Complex Analysis
 Chairman: R. Hurri-Syrjanen
- 11:05 - 11:35 A. Ukhlov, *Conformal composition operators and Brennan's conjecture*
 11:35 - 12:05 V. Gol'dshtein, *Conformal weights and embedding operators*
 12:15 - 12:45 S. Vodopyanov, *On mappings with bounded codistortion*
 12:45 - 13:15 M. Bekker, *Automorphic-invariant isometric operators and their unitary extensions*
Afternoon Session 4: Multi-dimensional Complex Analysis
 Chairman: M. Budzyńska
- 14:45 - 15:15 A. Vidras, *Briançon-Skoda theorem for quotient ring*
 15:55 - 15:45 P. Liczberski, *Domains with conically accessible boundary in multi-dimensional case*
 Chairman: A. Sergeev
- 16:00 - 16:30 V. Zakharyuta, *Internal capacity characteristics of domains in several complex variables*

- 16:30 - 17:00 L. Aizenberg, *The separation of singularities of holomorphic functions*
 17:30 - 18:00 S. Myslivetz, *Holomorphic extension of functions along the finite families of complex lines in a ball of \mathbb{C}^n*

Wednesday - May 22, 2013

- 09:00 - 09:45 Plenary Lecture 6
 Vincent Moncrief, *Lightcone estimates for spacetime curvature in general relativity*
- 09:50 - 10:35 Plenary Lecture 7
 Simeon Reich, *Problems and results in nonlinear analysis: An update*
- Morning Session 1: Integral Transforms and Spectral Theory*
 Chairman: A. Olevskii
- 11:10 - 11:55 M. Zaidenberg, *Automorphism groups of affine varieties and their Lie algebras*
 12:20 - 12:50 M. Sodin, *On the number of components of zero sets of smooth random functions of several real variables*
 12:50 - 13:20 Y. Yomdin, *Generalized Remez inequality for $(s;p)$ -valent functions*
- Afternoon Session 1: Integral Transforms and Spectral Theory*
 Chairman: M. Zaidenberg
- 14:45 - 15:15 N. Lev, *Multi-tiling and Riesz bases*
 15:15 - 15:45 D. Batenkov, *Accurate Fourier reconstruction of piecewise-smooth functions*
 16:15 - 16:45 L. Nguyen, *Spherical mean transform from a PDE point of view*
 16:45 - 17:15 E. Grinberg, *Integral transforms defined by intrinsic geometry of Riemannian manifolds*
- Morning Session 2: Complex Analysis*
 Chairman: K. Dyakonov
- 11:10 - 11:40 S. Krushkal, *Strengthened Grunsky and Milin inequalities*
 11:40 - 12:10 A. Solynin, *Minimization of area: Iceberg-type problems in the plane*
 12:20 - 12:50 J. Globevnik, *Boundary values of holomorphic functions in terms of the argument principle*
 12:50 - 13:20 J. Dziok, *Analytic functions associated with functions of bounded variation*
- Afternoon Session 2: Complex Analysis*
 Chairman: M. Zaidenberg
- 14:45 - 15:15 M.D. Contreras, *Boundary behavior of the iterates of a self-map of the unit disk*
 15:15 - 15:45 V. Bolotnikov, *Shift-invariant subspaces, inner functions and related linear systems: the weighted Bergman space setting*
- Morning Session 3: Partial Differential Equations*
 Chairman: M. Gobbino
- 11:10 - 11:40 M. Reissig, *Semi-linear structural damped waves*
 11:40 - 12:10 M. Cicognani, *Well-posedness for degenerate Schrödinger equations*
 12:20 - 12:50 E.S. Titi, *On the loss of regularity for the three-dimensional Euler equations*
 12:50 - 13:20 Y. Guo, *Persistency of analyticity for quasi-linear wave equations: an energy-like approach*

Afternoon Session 3: Partial Differential Equations

Chairman: E. Titi

14:45 - 15:15 O. Kelis, *On solvability of multi-order parabolic systems*

Morning Session 4: General Relativity

Chairman: G. Galloway

11:10 - 11:40 F. Schwartz, *Geometric inequalities for hypersurfaces*

11:40 - 12:10 N.Charalambous, *The essential spectrum of the Laplacian on complete manifolds*

12:20 - 12:50 D. Fajman, *Nonlinear stability for the Einstein-Vlasov system*

12:50 - 13:20 T. Oliynyk, *Dynamical compact bodies in general relativity*

Afternoon Session 3: General Relativity

Chairman: F. Schwartz

14:45 - 15:15 C. Cederbaum, *Uniqueness of photon spheres in static spacetimes*

15:15 - 15:45 K. Moore, *Evolving hypersurfaces by their inverse null mean curvature*

16:45 - 17:15 G. Weinstein, *The Penrose Inequality with charge*

Thursday - May 23, 2013

09:00 - 09:45 Plenary Lecture 8

P. Topping, *Instantaneously Complete Ricci flows*

09:50 - 10:35 Plenary Lecture 9

V. Maz'ya, *Bounds for eigenfunctions of the Laplacian on noncompact Riemannian manifolds*

Morning Session 1: Integral Transforms and Spectral Theory

Chairman: P. Kuchment

11:00 - 11:45 Z. Rudnick, *Nodal intersections*

12:10 - 12:40 V. Gichev, *Some metric properties of polynomials on compact homogeneous spaces*

12:40 - 13:10 K. Taylor, *Intersections of fractal sets*

Morning Session 2: Dynamics and Loewner Theory

Chairman: F. Bracci

11:10 - 11:30 S. Diaz-Madriral, *Local and global aspects in Loewner theory*

11:30 - 12:00 P. Gumenyuk, *Boundary behaviour of one-parameter semigroups and evolution families*

12:10 - 12:40 G. Ivanov, *Non-exploding analytic diffusions in the unit disk*

Morning Session 3: Free Boundary Problems

Chairman: A. Solynin

11:00 - 11:30 D. Khavinson, *An overdetermined boundary value problem*

11:30 - 12:00 A. Klein, *Viscous fingering in the evaporation fronts of thin liquid films*

12:10 - 12:40 T. Savina, *On some generalized Hele-Shaw flows*

12:40 - 13:10 R. Hurri-Syrjanen, *On fractional Poincaré inequalities*

Morning Session 4: General Relativity

Chairman: G. Weinstein

11:00 - 11:45 J. Solomon, *The space of positive Lagrangian submanifolds*

12:10 - 12:55 E. Milman, *Sharp isoperimetric inequalities and model spaces for the Curvature-Dimension-Diameter condition*

Friday - May 24, 2013

09:10 - 09:55 Plenary Lecture 10

D. Vassiliev, *Spectral theory of first order elliptic systems*

10:30 - 11:15 Plenary Lecture 11

A. Vasiliev, *Stochastic Loewner-Kufarev evolution with a random Herglotz field*

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