CONFERENCE PROGRAM

SATURDAY, June 25

09:00–10:00 REGISTRATION

10:00–10:30 **N. Nikolski.** *A few words on Victor Petrovich Havin.*

10:35–11:20 **V. Milman.** *Algebraic related structures and the reason behind some classical constructions in convex geometry and analysis.*

Coffee break

11:50–12:35 **J. Brennan.** *Хавин, луночка и я.*

12:40–13:25 **S. Smirnov.** *Clusters, loops and trees in the Ising model.*

Lunch

15:30–16:15 **V. Maz'ya.** *Sobolev inequalities in arbitrary domains.*

Coffee break

16:40–17:25 **V. Eiderman.** *On the maximum principle for vector Riesz potentials.*

17:30–18:15 **A. Aleksandrov.** *Operator Lipschitz functions and spaces of analytic functions.*

18:15 WELCOME PARTY

SUNDAY, June 26

10:00–10:45 **B. Mityagin.** *Geometry of dilated systems and root systems of non-selfadjoint operators.*

Coffee break

11:15–12:00 **A. Poltoratski.** *Toeplitz order and completeness problems.*

12:05–12:50 **K. Dyakonov.** *Smooth analytic functions and model subspaces.*

12:55–13:15 **T. Shaposhnikova.** *Logarithmic interpolation-embedding inequalities on irregular domains.*

Lunch

15:00–15:20 **E. Abakumov.** *Cyclicity in the harmonic Dirichlet space.*

15:25–15:45 **N. Shirokov.** *Analog of Havin–Shamoyan theorem for the ball.*

15:50–16:10 **M. Mateljevic.** *Interior estimates for Poisson type inequality and qc hyperbolic harmonic mappings.*

16:15–16:35 **K. Fedorovskiy.** *One problem of C^1-approximation of functions by solutions of elliptic PDE.*

Coffee break

17:00–17:20 **V. Goryainov.** *Holomorphic self-maps of the unit disc with two fixed points.*

17:25–17:45 **P. Ohrysko.** *Spectrally reasonable measures.*

17:50–18:10 **K. Kazaniecki.** *On the boundedness of differential operators in L^∞ norm.*

18:15–18:35 **B. Khabibullin.** *On the distribution of zeros for holomorphic functions of several variables.*

MONDAY, June 27

10:00–10:45 **V. Peller.** *Lifshitz–Krein trace formula and operator Lipschitz functions.*

Coffee break

11:15–12:00 **L. Baratchart.** *Hardy–Hodge decomposition of vector fields.*

12:05–12:50 **B. Juhl-Jöricke.** *Braid invariants and the conformal modulus of slalom curves.*

12:55–13:15 **E. Korotyaev.** *KdV and NLS via the Löwner type equation.*

Lunch

15:00 EXCURSION

TUESDAY, June 28

10:00–10:45 **S. Petermichl.** *Classical singular operators on integers and their L^p norms.*

Coffee break

11:15–12:00 **E. Malinnikova.** *Complex Jacobi matrices and sharp uniqueness results for discrete Schrödinger evolution.*

12:05–12:50 **A. Borichev.** *Multiple sampling and interpolation in the Fock space.*

12:55–13:15 **R. Zarouf.** *On the asymptotic behavior of Jacobi polynomials with varying parameters.*

Lunch

15:00–15:20 **S. Platonov.** *About spectral synthesis in the space of tempered functions on discrete abelian groups.*

15:25–15:45 **A. Mirotin.** *On bounded perturbations of Bernstein functions of several semigroup generators on Banach spaces.*

15:50–16:10 **A. Hartmann.** *Multipliers between model spaces.*

16:15–16:35 **D. Stoliarov.** *Operator of integration on the space of bounded analytic functions.*

Coffee break

17:30–18:30 CONCERT

19:30 CONFERENCE DINNER

WEDNESDAY, June 29

10:00–10:45 **A. Logunov.** *Nodal sets of Laplace Eigenfunctions: pursuing the conjectures by Yau and Nadirashvili.*

Coffee break

11:15–12:00 **G. Pisier.** *Sidon sets in bounded orthonormal systems.*

12:05–12:50 **N. Young.** *A generalization to several variables of Loewner's Theorem on operator-monotone functions.*

12:55–13:15 **Z. Lykova.** *The norm-preserving extension property in the symmetrized bidisc* Γ *and von Neumann-type inequalities for* Γ*-contractions.*

Lunch

15:00–15:45 **I. Verbitsky.** *A sublinear version of Schur's lemma.*

15:50–16:35 **H. Hedenmalm.** *Bloch functions and asymptotic tail variance.*

Coffee break

17:00–17:20 **I. Videnskii.** *Blaschke product for a Hilbert space with Schwarz–Pick kernel.*

17:25–17:45 **S. Charpentier.** *Small Bergman–Orlicz spaces, growth spaces, and their composition operators.*

17:50–18:10 **M. Malamud.** *Scattering Matrices for realizations of Schrödinger operators in exterior domains.*

THURSDAY, June 30

10:00–10:45 **A. Vershik.** *More about uncertainty principle: the last talks with V.P.*

Coffee break

11:15–12:00 **M. Rudelson.** *Non-asymptotic random matrix theory.*

12:05–12:50 **D. Chelkak.** *2D Ising model: discrete holomorphicity, orthogonal polynomials and conformal invariance.*

12:55–13:15 **D. Yafaev.** *Quasi-diagonalization of Hankel operators and rational approximations of singular functions.*

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ABSTRACTS

E. Abakumov. *Cyclicity in the harmonic Dirichlet space.*

We discuss the problem of characterizing the cyclic vectors in the harmonic Dirichlet space. The talk is based on joint work with O. El-Fallah, K. Kellay and T. Ransford.

A. Aleksandrov. *Operator Lipschitz functions and spaces of analytic functions.*

This talk is a survey of results on operator Lipschitz functions related to certain spaces of analytic functions. A continuous function f on the real line is called operator Lipschitz if

$$\|f(A) - f(B)\| \leq \text{const}\|A - B\|$$

for every self-adjoint operators A and B. Special attention will be given to case where f admits analytic continuation to the upper half-plane, i.e., f' belongs to the space H^∞ on the upper half-plane.

L. Baratchart. *Hardy–Hodge decomposition of vector fields.*

We discuss a decomposition of vector fields on hypersurfaces into harmonic gradients and divergence free components, that generalizes the classical decomposition of L^p into Hardy spaces on a curve in the plane. We discuss applications to inverse potential problems and to approximation of vector fields by harmonic gradients, which is a higher dimensional analog of analytic approximation.

A. Borichev. *Multiple sampling and interpolation in the Fock space.*

The multiple sampling and interpolation problems in the Fock space with bounded multiplicities were solved by Brekke and Seip in 1993. They are still open in the general case and we are going to discuss some partial results obtained in this direction together with Hartmann, Kellay, and Massaneda.

J. Brennan. *Хавин, луночка и я.*

On this occasion of the *25th St. Petersburg Summer Meeting in Mathematical Analysis* I am happy to recall a number of interests I have shared over many years with numerous individuals in the St. Petersburg mathematical community, and in particular with Victor Havin. A common feature of our individual efforts has been the application of potential theoretic ideas to certain problems having to do with approximation by polynomials or rational functions on, more or less arbitrary, bounded domains or compact subsets of the complex plane. It is my intention to summarize some of what has been achieved in these areas with a particular emphasis on the contributions of Victor Havin, and to mention two problems that have remained open for decades. In the process I will draw on the work of Beurling and Vol'berg on *general quasianalyticity*, the work of Maz'ya and Havin on *nonlinear potential theory*, as well as the more recent work of Mel'nikov and Tolsa on *analytic capacity.*

S. Charpentier. *Small Bergman–Orlicz spaces, growth spaces, and their composition operators.*

Bergman–Orlicz spaces A^ψ and Hardy–Orlicz H^ψ spaces are natural generalizations of classical Bergman spaces A^p and Hardy spaces H^p. Their introduction makes in particular sense when one studies the boundedness or the compactness of composition operators on $A^p(\mathbb{B}_N)$ and Hardy spaces $H^p(\mathbb{B}_N)$ of the unit ball $\mathbb{B}_N$ of $\mathbb{C}^N$, $N \geq 1$. For instance, when $N > 1$, it is known that not every composition operator is bounded on $A^p(\mathbb{B}_N)$ and $H^p(\mathbb{B}_N)$ and it is a natural problem to find "reasonable" examples of Banach spaces of holomorphic functions on which every composition operator is bounded. In earlier work, it was shown that small Bergman–Orlicz and Hardy–Orlicz spaces provide such examples.

In this talk, we will characterize those Bergman–Orlicz spaces A^ψ on which every composition operator is bounded, in terms of the growth of the Orlicz function ψ. This will be done together with the characterization of those spaces which coincide with some growth spaces of holomorphic functions. By passing, we will see that the boundedness of any operator on such space becomes equivalent to an *a priori* stronger property which, in the setting of A^2, corresponds to being Hilbert–Schmidt. Then we will characterize the compactness of composition operators on those small Bergman–Orlicz spaces.

D. Chelkak. *2D Ising model: discrete holomorphicity, orthogonal polynomials and conformal invariance.*

The Ising model is the simplest lattice model of a ferromagnet suggested by Lenz in 1920, which is now considered to be an archetypical example of a statistical mechanics system for which the appearance of the conformal symmetry at criticality in dimension two can be rigorously understood in great detail. We start this talk with a brief discussion of the so-called discrete fermionic observables, their spinor generalizations, and the discrete holomorphicity property naturally appearing in the model. Then we illustrate our approach to the analysis of spin correlations by a derivation of two classical explicit formulae in the infinite-volume limit via classical orthogonal polynomials techniques. Finally, we describe the convergence results (as the mesh size tends to zero, in arbitrary planar domains, to conformally covariant limits) for multi-point spin correlations following the joint work with Clement Hongler (Lausanne) and Konstantin Izyurov (Helsinki).

K. Dyakonov. *Smooth analytic functions and model subspaces.*

We discuss various connections and a peculiar duality between the two topics in the title.

V. Eiderman. *On the maximum principle for vector Riesz potentials.*

The recent remarkable progress in the theory of analytic capacity (and more general, of Calderón-Zygmund capacities) is based on the study of the relation between boundedness of the vector Riesz operator $R^s_\mu f$

from $L^2(\mu)$ to $L^2(\mu)$, and geometric properties of a measure μ. Here

$$R^s_\mu f(x) = \int \frac{y-x}{|y-x|^{s+1}} f(y)\, d\mu(y), \qquad x, y \in \mathbb{R}^d, \quad 0 < s < d.$$

The key role in the proofs of several results plays the relation

$$\max_{x\in\mathbb{R}^d} |R^s_\mu \mathbf{1}(x)| \le C \max_{x\in \operatorname{supp}\mu} |R^s_\mu \mathbf{1}(x)|, \quad C = C(d,s),$$

which for all $s \in (0,d)$ and even for measures with smooth densities is still an open problem. We give a survey of related results and indicate the methods used for different s.

K. Fedorovskiy. *One problem of C^1-approximation of functions by solutions of elliptic PDE.*

Let X be a compact subset of the complex plane and let $\mathcal{L}$ be some elliptic partial differential operator with constant complex coefficients. It is planned to discuss the following question which is closely related with one topic which has been interesting to V. P. Havin: What conditions on X are necessary and sufficient in order that every triplet (g_0, g_1, g_2) of continuous functions on X can be approximated on X by some sequence of polynomials $\{P_n\}$ satisfying the condition $\mathcal{L}P_n = 0$ in such a way that the sequence $\{P_n\}$ itself converges uniformly on X to g_0, and the sequence $\{\nabla P_n\}$ converges uniformly on X to (g_1, g_2).

V. Goryainov. *Holomorphic self-maps of the unit disc with two fixed points.*

We study the holomorphic self-maps of the unit disc with two fixed points. There are two cases: one fixed point is interior or both fixed points belong to the boundary of the unit disc. We describe the range of values for the function and its derivatives at the fixed points. For some classes of functions, we find the domains of univalence.

I. Guryanova. *Volterra integral equations in the generalised treatment.*

We consider the question of asymptotic equivalence of the equations

$$x(t) = f(t) + \int_{M(t)} K\big(t, s, x(s)\big) d\mu(s)$$

and

$$x(t) = f(t) + \int_{M(t)} K\big(t, s, x(s) + g(s, x(s)\big) d\mu(s),$$

where $t \in \Omega$, Ω is a connected locally compact metric space; the measure μ is defined on Borel sets $A \subseteq \Omega$; the functions $f : \Omega \to \mathbb{R}$ and $K : \Omega^2 \times \mathbb{R} \to \mathbb{R}$ are continuous; the image $M : \Omega \to 2^\Omega$ satisfies the following system of axioms, which generalizes the notion of the Volterra type integral equation:

1. For any $t \in \Omega$, $M(t)$ is a compact set; moreover, for any open $\mathcal{J} \subset \Omega$, if $\mathcal{J} \cap M(t) \neq \varnothing$, then $\mu(\mathcal{J} \cap M(t)) \neq \varnothing$.
2. For any $t \in \Omega$, $\lim_{s \to t} \mu(M(t) \Delta M(s)) = 0$, where Δ denotes the symmetrical difference.
3. For any $t \in \Omega$, $s \in M(t) \Longrightarrow M(s) \subset M(t)$.
4. For any $t \in \Omega$, there exists $s \in M(t)$ such that $M(s) = \varnothing$.

We obtain conditions of asymptotic equivalence of the equations.

A. Hartmann. *Multipliers between model spaces.*

In this talk we are interested in multipliers from one model space to another one. Our central result asserts that these can be characterized in terms of suitable kernels of Toeplitz operators and Carleson measures. This problem has previously been studied by Crofoot in the situation of onto multipliers. In certain situations it turns out that the multipliers are necessarily bounded so that the Carleson measure condition is not required. However, this is not always the case as we will see in different examples.

We also consider model spaces of the upper-half plane, where we will discuss in some detail the situation when the associated inner function is meromorphic which connects the problem to de Branges spaces of entire functions. When the derivative of the associated inner function is bounded, we show that the multipliers can be described as the kernel of a certain Toeplitz operator without appealing to the Carleson measure condition. The upper half plane is also a convenient setting to resolve Crofoot's question on the existence of unbounded onto multipliers in the positive.

H. Hedenmalm. *Bloch functions and asymptotic tail variance.*

We introduce the concept of asymptotic tail variance, and show how it relates to known conjectures on integral means spectra. Moreover, we obtain a sharp estimate for the asymptotic tail variance of the Bergman projection of a bounded function, which leads to the estimate

$$B(k,t) \leq (1/4)k^2|t|^2(1+7k)^2.$$

B. Juhl-Jöricke. *Braid invariants and the conformal modulus of slalom curves.*

I will briefly introduce braids and state an asymptotic estimate of a 3-braid invariant. The problem leads to a problem of complex analysis, to give an asymptotic estimate of the conformal module of slalom curves. Slalom curves are curves in $\mathbb{C} \setminus \mathbb{Z}$, the complex plane punctured at all integers, with endpoints on $\mathbb{R} \setminus \mathbb{Z}$, the real axis minus integers. The conformal module of a slalom curve is the supremum of the conformal modules of rectangles with sides parallel to the axes which have the following property. They admit a holomorphic mapping into $\mathbb{C} \setminus \mathbb{Z}$ which maps horizontal sides to $\mathbb{R} \setminus \mathbb{Z}$ and represent the slalom curve in the following sense. The restriction of the map to a vertical side of the rectangle is homotopic to the slalom curve in $\mathbb{C} \setminus \mathbb{Z}$ relative to $\mathbb{R} \setminus \mathbb{Z}$.

K. Kazaniecki. *On the boundedness of differential operators in L^∞ norm.*

We study conditions which can determine whether the norm of a differential operator with constant coefficients is bounded by the norms of other operators of this type. We show a sufficient condition for an existence of such estimates using N-quasi ellipticity of a certain polynomial. The talk is based on a joint work with M. Wojciechowski.

B. Khabibullin. *On the distribution of zeros for holomorphic functions of several variables.*

Let $\mathbb{C}^n$ be the n-dimensional Euclidian complex space, $n = 1, 2, \dots$. Let D be a non-empty open connected subset in $\mathbb{C}^n$ with boundary ∂D, and let K be a compact subset of D with non-empty interior and boundary ∂K. Denote by $\operatorname{sbh}_*(D)$ the *class of all subharmonic functions* $u \not\equiv -\infty$ on D with *Riesz measure* $\nu_u = \frac{(n-1)!}{2\pi^n \max\{1,2n-2\}} \Delta u \geq 0$, where Δ is *the Laplace operator* acting in the sense of distribution theory. Let b be a positive number. Denote by $\operatorname{sbh}_0^+(D \setminus K; \leq b) \subset \operatorname{sbh}_*(D \setminus K)$ the class of all functions $v \in \operatorname{sbh}_*(D \setminus K)$ such that $v(z) \geq 0$ for all $z \in D \setminus K$, $\lim\limits_{D \ni z' \to z} v(z') = 0$ for all $z \in \partial D$, and $\limsup\limits_{D \ni z' \to z} v(z') \leq b$ for all $z \in \partial K$. Denote by σ_{2n-2} the $(2n-2)$-*dimensional surface* (Hausdorff) *measure* on $\mathbb{C}^n$. So, for $n = 1$, i. e., $2n-2 = 0$, we have $\sigma_0(S) = \sum_{z \in S} 1$ for each $S \subset \mathbb{C}$, that is, $\sigma_0(S)$ is equal to the number of points in the set $S \subset \mathbb{C}$. Our main result is the following one:

Theorem. *Assume that* $\mathsf{Z} \subset D \setminus K$, $u \in \operatorname{sbh}_*(D)$ *with Riesz measure* ν_u, *and* b *is a positive number. Let* f *be a holomorphic function on* D *such that* $f(z) = 0$ *for all* $z \in \mathsf{Z}$, *and* $\bigl|f(z)\bigr| \leq \exp u(z)$ *for all* $z \in D$. *Then there is a constant* $C \geq 0$ *such that*

$$\int_{\mathsf{Z}} v \, \mathrm{d}\sigma_{2n-2} \leq \int_{D \setminus K} v \, \mathrm{d}\nu_u + C \quad \textit{for all} \quad v \in \operatorname{sbh}_0^+(D \setminus K; \leq b).$$

This is joint work with N. Tamindarova. Our research is supported by RFBR grant (project no. 16-01-00024).

E. Korotyaev. *KdV and NLS via the Löwner type equation.*

We consider the KdV and the defocussing NLS equations on the circle. A new approach to study the Hamiltonian as a function of action variables is proposed. The problems for the integrable equations are reformulated as the problems of conformal mapping theory corresponding to quasimomentum of Schrödinger operator and Zakharov-Shabat operator. The main tool is the Löwner type equation for the quasimomentum.

A. Logunov. *Nodal sets of Laplace Eigenfunctions: pursuing the conjectures by Yau and Nadirashvili.*

We will discuss the recent progress in understanding zero sets of Laplace eigenfunctions and harmonic functions.

Z. Lykova. *The norm-preserving extension property in the symmetrized bidisc Γ and von Neumann-type inequalities for Γ-contractions.*

A set V in a domain U in $\mathbb{C}^n$ has the norm-preserving extension property if every bounded holomorphic function on V has a holomorphic extension to U with the same supremum norm. We describe all algebraic subsets of the symmetrized bidisc

$$G \overset{\text{def}}{=} \{(z+w, zw) : |z| < 1, \ |w| < 1\}$$

which have the norm-preserving extension property. In contrast to the case of the ball or the bidisc, there are sets in G which have the norm-preserving extension property, but are not holomorphic retracts of G. We give applications to von Neumann-type inequalities for Γ-contractions (that is, commuting pairs of operators for which the closure of G is a spectral set) and for symmetric functions of commuting pairs of contractive operators. The talk is based on joint work with Jim Angler and Nicholas Young.

[1] Jim Angler, Zinaida A. Lykova and N. J. Young, Geodesics, retracts, and the norm-preserving extension property in the symmetrized bidisc, *arXiv*, April 2016, 100 pages.

L. Maergoiz. *An analogue of a Polya theorem for Puiseux series and some applications.*

For Puiseux series, we obtain an analogue of a Pólya theorem. The result in question relates the indicator of an entire function $f(z) =$

$\sum_{k=0}^{\infty} c_k \frac{z^k}{k!}$ of exponential type and its conjugate diagram, i.e., the domain of absolute convergence of the Laplace transform

$$G_\theta(p) = \int_0^{\infty(\mathrm{Arg} z = \theta)} e^{-pz} f(z)\, dz, \qquad \theta \in [-\pi, \pi]$$

of f. Here the function family $\{G_\vartheta(p)\}_{\vartheta \in [-\pi,\pi]}$ is the analytic continuation of the series $g(p) = \sum_{k=0}^{\infty} \frac{c_k}{p^{k+1}}$ associated with f. This result can be used to describe the domain of analytic continuations of Puiseux series given at a vicinity of infinity in a representation of solutions of algebraic equations.

M. Malamud. *Scattering Matrices for realizations of Schrödinger operators in exterior domains.*

Let A be a symmetric operator in a Hilbert space $\mathfrak{H}$ with infinite deficiency indices $n_\pm(A) = \infty$. We investigate the scattering matrix of two extensions A_0 and A_1 assuming that they are resolvent comparable, i.e., their resolvent difference is of trace class. The scattering matrix is expressed by means of the limit values of the abstract Weyl function.

The abstract result is applied to different realizations of Schrödinger differential expressions in exterior domains in $\mathbb{R}^2$. In particular, if A_D and A_N are the Dirichlet and Neumann realizations, then the scattering matrix of the scattering system $\{A_D, A_N\}$ is expressed by means of the limit values of the Dirichlet-to-Neumann map. The latter is the classical object naturally appearing in the theory of boundary value problems of the second order elliptic operators.

The talk is based on joint work with J. Behrndt and H. Neihardt.

E. Malinnikova. *Complex Jacobi matrices and sharp uniqueness results for discrete Schrödinger evolution.*

We consider the semi-discrete Schrödinger equation with continuous time and time independent bounded complex-valued potential. Applying the Shohat–Favard theorem for the corresponding complex Jacobi matrix, we obtain sharp uniqueness result for the solutions of such equations. It says that a non-zero solution cannot decay fast at two distinct times. This is a discrete version of a generalized Hardy uncertainty principle. The connections will be explained in the talk that is based on joint work with Yurii Lyubarskii.

M. Mateljevic. *Interior estimates for Poisson type inequality and qc hyperbolic harmonic mappings.*

We study quasiconformal (qc) mappings in plane and space and in particular Lipschitz-continuity of mappings which satisfy in addition certain PDE equations (or inequalities). Some of the obtained results can be considered as versions of Kellogg–Warshawski type theorem for qc-mappings. We plan to discuss a major breakthrough concerning the initial Schoen Conjecture (and more generally the Schoen–Li–Wang conjecture) made very recently (Markovic and the others including members of Belgrade seminar). Among other things, we use as a tool the interior estimates for Poisson type inequality and we try to imply it to study boundary regularity of Dirichlet Eigenfunctions on bounded domains which are C^2 except a finite number of corners (related to Y. Sinai's question).

V. Maz'ya. *Sobolev inequalities in arbitrary domains.*

A theory of Sobolev inequalities in arbitrary open sets in $\mathbb{R}^n$ is offered. Boundary regularity of domains is replaced with information on boundary traces of trial functions and of their derivatives up to some explicit minimal order. The relevant Sobolev inequalities involve constants independent of the geometry of the domain, and exhibit the same critical exponents as in the classical inequalities on regular domains. Our approach relies upon new representation formulas for Sobolev functions, and on ensuing pointwise estimates which hold in any open set. This is joint work with A. Cianchi.

V. Milman. *Algebraic related structures and the reason behind some classical constructions in convex geometry and analysis.*

A. Mirotin. *On bounded perturbations of Bernstein functions of several semigroup generators on Banach spaces.*

This talk is devoted to the (multidimensional and one-dimensional) Bochner–Phillips functional calculus. Bounded perturbations of Bernstein functions of (one or several commuting) semigroup generators on Banach spaces are considered, conditions for Lipschitzness and Frechet-differentiability of such functions are obtained, estimates for the norm of commutators are proved, and a trace formula is derived.

B. Mityagin. *Geometry of dilated systems and root systems of non-selfadjoint operators.*

We discuss completeness, minimality, and basisness, in L^2 and L^p, $p \neq 2$, of systems of functions in three families:

(a) eigensystems, or root systems, of Hill operators on a finite interval, with periodic or antiperiodic boundary conditions;

(b) root systems of the perturbed Harmonic Oscillator Operator

$$Hu = -u'' + x^2 u + b(x)u;$$

(c) dilated systems $u_n(x) = S(nx)$, $n \in \mathbb{N}$, where S is a trigonometric polynomial

$$S(x) = \sum_{k=0}^{m} a_k \sin(kx), \quad a_0 a_m \neq 0.$$

Although the questions asked are the same, the techniques vary to use and blend (in the spirit of Victor Havin) a wide range of methods in real and complex analysis. We will present a series of results on the systems (a), (b), (c) from [1] –[5] and more, and mention a few unsolved questions.

[1] Plamen Djakov and Boris Mityagin. Convergence of spectral decompositions of Hill operators with trigonometric polynomial potentials. *Math. Ann.* 351 (2011), no. 3, 509–540.

[2] James Adduci and Boris Mityagin. Eigensystem of an L^2-perturbed harmonic oscillator is an unconditional basis. *Cent. Eur. J. Math.* 10 (2012), no. 2, 569–589.

[3] Boris Mityagin, Petr Siegl, and Joe Viola. Differential operators admitting various rates of spectral projection growth. *arXiv:1309.3751* [math.SP].

[4] Boris Mityagin. The spectrum of a harmonic oscillator operator perturbed by point interactions. *Int. J. Theor. Phys.* 54 (2015), no. 11, 4068–4085.

[5] Boris Mityagin and Petr Siegl. Root system of singular perturbations of the harmonic oscillator type operators. *Lett. Math. Phys.* 106 (2016), no. 2, 147–167; *arXiv:1307.6245v1* [math.SP].

I. Novikov. *Riesz Lemma and Bernstein Polynomials.*

The report focuses on the possibility to organize, preserving convergence, the removal of non-negative trigonometric roots of polynomials converging to a piecewise-analytic function. The most interesting for the author is the case where the trigonometric polynomials are determined by means of Bernstein polynomials approximating a piecewise linear function. This issue is related to the compactly supported wavelets construction which preserves the localization with increasing smoothness.

P. Ohrysko. *Spectrally reasonable measures.*

In this talk I will present new results concerning spectral properties of the measure algebra. The detailed study of the set of measures with natural spectrum (equal to the closure of the set of the values of the Fourier–Stieltjes transform) will be provided. I am going to focus on the situation when the sum of two measures with natural spectra also have a natural spectrum (this does not hold in general — see Example 3.4 in the following paper by M. Zafran: On Spectra of Multipliers, *Pacific J. Math.* 47 (1973), no. 2). Measures with the property of perturbing any measure with a natural spectrum to a measure with a natural spectrum will be called *spectrally reasonable.* It is quite surprising that the set of all such measures has a Banach algebra structure which gives many additional tools to analyze problems in this area. During the talk I will present the proof of the fact that absolutely continuous (more generally — all measures from Zafran's class) are spectrally reasonable. However, discrete measures (except trivial examples) will be shown not to have this property which implies that shifting a measure may map a measure with a natural spectrum to one for which this is not the case. The talk is based on joint work with Michał Wojciechowski ("Spectrally reasonable measures," St. Petersburg Math. J., to appear).

V. Peller. *Lifshitz–Krein trace formula and operator Lipschitz functions.*

I am going to speak about a solution of the problem to describe the maximal class of functions, for which the Lifshitz–Krein trace formula holds for arbitrary self-adjoint operators with trace class difference. This class of functions coincides with the class of operator Lipschitz functions.

S. Petermichl. *Classical singular operators on integers and their L^p norms.*

We present an approach via stochastic analysis and/or Bellman function to tackling sharp L^p estimates of singular operators on (products of) integers. This approach is successful for second order Riesz transforms: we present two different proofs for obtaining the optimal estimate in L^p. The first approach is deterministic and via Bellman functions, the second approach is through a stochastic integral formula using jump processes. We write such a formula also for a discrete Hilbert transform, having orthogonality inspired by some Cauchy–Riemann equations. Related to the nature of jump processes and their quadratic covariation, we are illustrating the fundamental difference in difficulty between Hilbert and second order Riesz transform that is invisible in the continuous setting.

G. Pisier. *Sidon sets in bounded orthonormal systems.*

A set of integers is called Sidon if any continuous function on the unit circle with spectrum in the set has an absolutely convergent Fourier series. We will recall some of the classical theory of Sidon sets of integers, or more generally of characters on compact groups (Abelian or not). We will then give several recent extensions to Sidon sets, randomly Sidon sets and subgaussian sequences in bounded orthonormal systems, following recent work by Bourgain and Lewko, and by the author, both currently available on arxiv.

S. Platonov. *About spectral synthesis in the space of tempered functions on discrete abelian groups.*

Let G be a discrete abelian group. A topological vector space of functions $\mathcal{F}$ on G is said to be translation invariant if the translation operators $\tau_y : f(x) \mapsto f(x+y)$ leave $\mathcal{F}$ invariant and are continuous on $\mathcal{F}$. A closed translation invariant subspace H of $\mathcal{F}$ is said to admit spectral synthesis if H is the $\mathcal{F}$-closure of all exponential polynomials belonging to H. Spectral synthesis occurs in $\mathcal{F}$ if every closed invariant subspace H admits spectral synthesis. We study the problem when the spectral synthesis occurs in the space of tempered functions on discrete abelian groups.

A. Poltoratski. *Toeplitz order and completeness problems.*

Toeplitz operators induce a natural partial ordering on the set of inner functions. The study of this ordering and the corresponding equivalence classes provides a new point of view for a wide range applications including completeness problems, spectral problems, the two-weight Hilbert problem, etc. In my talk I will give an overview of the Toeplitz order and discuss some new results and further questions.

O. Rovenska. *Approximation of analytic functions by linear means of Fourier sums.*

The work concerns the questions of approximation of periodic differentiable functions of high smoothness by repeated arithmetic means of

Fourier sums. In certain cases, asymptotic equalities are found for upper bounds of deviations in the uniform metric of the repeated de la Vallée-Poussin sums on the classes, which are generated by multiplicators and shifts of argument, provided that sequences which define the specified classes tend to zero with the rate of geometrical progression. These classes consist of analytic functions, which can be regularly extended in the corresponding strip.

M. Rudelson. *Non-asymptotic random matrix theory.*

Random matrices arise naturally in various contexts ranging from theoretical physics to computer science. In a large part of these problems, it is important to know the behavior of the spectral characteristics of a random matrix of a large but fixed size. We will discuss a recent progress in this area illustrating it by problems coming from different directions:

(1) Condition number of "full" and sparse random matrices. Consider a system of linear equations $Ax = b$ where the right hand side is known only approximately. In the process of solving this system, the error in vector b gets magnified by the condition number of the matrix A. A conjecture of von Neumann that with high probability, the condition number of an $n \times n$ random matrix with independent entries is $O(n)$ has been proved several years ago. We will discuss this result as well as the possibility of its extension to sparse matrices.

(2) The Single Ring Phenomenon. It was observed by physicists, that the eigenvalues of a large random matrix with a prescribed distribution of the singular values densely fill a single ring in the complex plane even if the distribution of the singular values has gaps. This phenomenon has been rigorously verified recently.

(3) Random matrices in combinatorics. A perfect matching in a graph with an even number of vertices is a pairing of vertices connected by edges of the graph. Evaluating or even estimating the number of perfect matchings in a given graph deterministically may be computationally expensive. We will discuss an application of the random matrix theory to estimating the number of perfect matchings in a deterministic graph.

T. Shaposhnikova. *Logarithmic interpolation-embedding inequalities on irregular domains.*

Logarithmic interpolation-embedding inequalities of Brezis–Gallouet–Wainger type are proved for various classes of irregular domains, in particular, for power cusps and lambda-John domains. This is joint work with Vladimir Maz'ya.

N. Shirokov. *Analog of Havin–Shamoyan theorem for the ball.*

Let f be a function holomorphic in the unit ball B^n, $n > 1$, and continuous in the closed ball. Assume that $f(z)$ does not vanish in B^n and $|f|$ is in the Hölder class H^α, $0 < \alpha < 1$, on the unit sphere. Then f is in the Hölder class $H^{\alpha/2}$ in the closed ball.

S. Smirnov. *Clusters, loops and trees in the Ising model.*

The Ising model is an archetypal model of an order-disorder phase transition, assigning spins randomly to lattice sites, with nearby spins aspiring to be the same, with force changing with temperature. Though simple to formulate, it exhibits a complex behavior, much like the real-world phenomena in physics, chemistry, biology, computer science. Surprisingly, in the 2D case it allows for a very detailed analysis, with many methods developed since the breakthrough work of Lars Onsager. We will give a historical introduction, leading to more recent results about the 2D case, giving a geometric description of the Ising model configurations and their scaling limits. The talk is based on joint work with Antti Kemppainen.

D. Stoliarov. *Operator of integration on the space of bounded analytic functions.*

The operator of integration is bounded on $H^\infty(\Omega)$ if and only if the interior diameter of $\Omega \subset \mathbb{R}^2$ is finite. I will outline a proof of this result and I will speak about specific approximation results for the solutions of the $\bar{\partial}$-equation; such results are used in the proof. This is joint work with Wayne Smith and Alexander Volberg.

I. Verbitsky. *A sublinear version of Schur's lemma.*

A sublinear form of Schur's lemma will be discussed, along with applications to nonlinear integral and differential equations.

A. Vershik. *More about uncertainty principle: the last talks with V.P.*

I will speak about our discussion with Victor during last 1,5 years related to the problem which I posed few years ago, and which was extremely closely related to his interests as well as to the uncertainty principle. The question was not to solve the problem — a positive answer has been given in terms of representation theory (of Heisenberg group) many years ago — but to give a simple and direct proof from the Fourier analysis point of view. V.P. had prepared two handwritten pages of letter to me (which I will spread on the conference) with his own reformulation of my question. But the simple proof still does not exist.

I. Videnskii. *Blaschke product for a Hilbert space with Schwarz–Pick kernel.*

For the functional Hilbert spaces with Schwarz–Pick kernel (this class is wider than the class of Hilbert spaces with Nevanlinna–Pick kernel), we define a metric — an analog of the hyperbolic metric in the unit disk. For a sequence satisfying an abstract Blaschke condition, we prove that the associated partial Blaschke products converge uniformly on any fixed bounded set and only finitely many elementary multipliers may have zeros on such a set. Also, we prove that the partial Blaschke products converge in the strong operator topology of the multiplier space.

D. Yafaev. *Quasi-diagonalization of Hankel operators and rational approximations of singular functions.*

We show that all Hankel operators are unitarily equivalent to pseudo-differential operators in $L^2(\mathbb{R})$ with amplitudes $a(x, y; \xi)$ of a very special structure:

$$a(x, y; \xi) = (\cosh(\pi x))^{-1/2} s(\xi) (\cosh(\pi y))^{-1/2}$$

where the function $s(\xi)$ is determined by the given Hankel operator. This result has numerous spectral applications. One of them (developed jointly with A. Pushnitski) concerns best rational approximations of functions with logarithmic singularities.

N. Young. *A generalization to several variables of Loewner's Theorem on operator-monotone functions.*

Loewner proved that a real-valued function f on an interval I of the real line acts monotonically on selfadjoint operators with spectrum in I if and only if f extends analytically to a function on the upper halfplane with nonnegative real part. We prove a generalization of this result to functions defined on certain open subsets of $\mathbb{R}^d$. This is joint work with Jim Angler and John E. McCarthy.

R. Zarouf. *On the asymptotic behavior of Jacobi polynomials with varying parameters.*

We study the large n behavior of Jacobi polynomials with varying parameters $P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ for $a>-1$ and $\lambda\in(0,\,1)$. This appears to be a well-studied topic in the literature but some of the published results are unnecessarily complicated or incorrect. The purpose of this talk is to provide a simple and clear discussion and to highlight some flaws in the existing literature. Our approach is based on a new representation for $P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ in terms of two integrals. The integrals' asymptotic behavior is studied using standard tools of asymptotic analysis: one is a Laplace integral and the other is treated via the method of stationary phase. In summary we prove that if $a\in(\frac{2\lambda}{1-\lambda},\infty)$ then $\lambda^{an}P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ shows exponential decay and we derive exponential upper bounds in this region. If $a\in(\frac{-2\lambda}{1+\lambda},\,\frac{2\lambda}{1-\lambda})$ then the decay of $\lambda^{an}P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ is $O(n^{-1/2})$ and if $a\in\{\frac{-2\lambda}{1+\lambda},\,\frac{2\lambda}{1-\lambda}\}$ then $\lambda^{an}P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ decays as $O(n^{-1/3})$. Lastly we find that if $a\in(-1,\frac{-2\lambda}{1+\lambda})$ then $\lambda^{an}P_n^{(an+\alpha,\beta)}(1-2\lambda^2)$ decays exponentially iff $an+\alpha$ is an integer and increases exponentially iff it is not. Our methods immediately yield the asymptotic expansion of the polynomials to any order.

The talk is based on a joint work with Oleg Szehr.