CURRICULUM VITAE

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I. PERSONAL DATA

Nom Alexandr Kosyak

Date and Place of Birth: August 4, 1955, Pilipcha, Kiev region, Ukraine

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Status: Divorced, 2 children

Languages: English, French, Russian, Ukrainian,

Nationality: Ukrainien

II. Degrees

1985 Candidat of Phys. and Math. Sci., Kiev, Institute of Mathematics of Ukrainian Academy of Sciences, Ukraine

Subject: Garding domain and extension of unitary representations of infinite-dimensional groups

Date end place: 12/11/1985, Kiev, Institute of Mathematics

Supervisor: Yu.M.Berezanskii

Opponents: R.S.Ismagilov, G.I.Ol'shanskii (Moscow)

III. Education 1972-1977 student, Kiev University, Ukraine

1982-1985 postgraduate student, Institute of Mathematics of Ukrainian Academy of Sciences

IV. Positions held

1972-1977 student, Kiev University, Ukraine

1977-1982 assistent Professor, Ukrainian Agricultural Academy

1982-1985 postgraduate student Institute of Mathematics of Ukrainian Academy of Sciences, Kiev, Ukraine

1985-2009 Scientific Researcher, Institute of Mathematics of Ukrainian Academy of Sciences, Kiev, Ukraine

V. Previous period of study and research abroad - in France

1992-1993 boursier du Ministère de la Recherche et de l'Espace à l'Université d'Aix-Marseille II, Département Mathématiques-Informatique (Luminy).

10/93 - 03/94 Maître de conférences invité à l'Université Claude Bernard Lyon 1, Institut de Mathématiques et d'Informatique,

03/94 -06/95 Professeur associé à l'Université d'Aix-Marseille II, Faculté des Sciences de Luminy, Département Mathématiques-Informatique (Luminy).

04/97-06/97 Chercheur Assosié au C.N.R.S - Centre National de la Recherche Scientifique à l'Institut de Methématique de Luminy,

03/99 Professeur invité à l'Institut Elie Cartan, Université de Nancy, I,

04/99 Professeur invité à l'Institut de Mathématiques de Luminy.

02/03-06/03 Professeur invité à l'Institut de Methématique de Luminy,

in Germany: 09/06-11/06, 10/07-03/08, 03/09-07/09 - visiteur in Max-Planck-Institut für Mathematik, Bonn, Allemagne,

V. International cooperation

Coordinator (ukrainian) of the Germany-Ukrainian DFG project 436 UKR 113/72 (2003-2006).

Coordinator (ukrainian) of the Germany-Ukrainian DFG project 436 UKR 113/87 (2006-2008).

VI. Participation in conferences:

European School on Group Theory, Session 1991, C.I.R.M. - Luminy, 22 juillet - 2 août, Marseille, 1991.

The 6th USSR - Japan Symposium on Probability Theory, Kiev, August 5 - 10, 1991.

2nd International Conf. on Algebra, Barnaul, Russia, August 23 - 27, 1991.

Algèbres d'Opérateurs 92, Orléans, 1 - 4 juillet, 1992.

Premier Congrès Européen de Mathématiques, Paris, 6 - 10 juillet, 1992.

Analyse sur les groupes et algèbras de Lie de dimension infinie, C.I.R.M.-Luminy, 15-19 septembre, Marseille, 1997.

International Congress of Mathematicians, August 18-27, 1998, Berlin, Germany.

International Conference "Stochastic Analysis and its Applications", 10-17 June, 2001, Lviv, Ukraine.

International Conference on Functional Analysis. August 22-26, 2001, Kyiv, Ukraine.

International Conference "Infinite-Dimensional Analysis", Octobre 8-12, 2001, Marseille, France.

International conference "Algebraic and Topological Dynamics", Max Plank Institute, Juin - July 2004, Bonn, Germany.

International conference "Spectral and evolutionary problems", September 16-30, 2005, Sevastopol', Ukraine.

VII. Experience of teaching:

1977-1982 Assistant professor in mathematics in the Agricultural Academy of Kiev, Ukraine,

1985 Lectures on representation theory, Kiev University, Ukraine

10/93 - 03/94 Maître de conférence invité à l'Université Claude Bernard Lyon 1, TD en DEUG-1, France

03/94 -06/95 Professeur associé à l'Université d'Aix-Marseille II, cours et TD en DEUG. Responsable de UV "Géométrie " en DEUG-2, France

02/03 - 06/03 Professeur invité à l'Université d'Aix-Marseille II, cours et TD en DEUG-1.

VIII. Area of research :

Representation theory

Lie groups and Lie algebras

Braid groups and quantum groups

Dynamical systems

Quasi-invariant mesures

Functional analysis

Operator algebras

IX. Themes of actuel research:

Representation theory of infinite-dimensional Lie groups and Lie algebras, braid groups and quantum groups

Group action, dynamical systems and quasi-invariantes mesures on infinite-dimensional groups

Orbit method for infinite-dimensional groups

Construction of new examples of factors and C^*-algebras using representation theory of infinite-dimensional groups

X. Summary.

All the following result are presented in the book [1] (in preparation).

It is well known that a general approach towards construction irreducible representations of infinite-dimensional topological groups does not exist. We try to develop such an approach by constructing an analogue of the regular representation, which is a powerful tool for investigation locally compact group representation.

Let G be a nonlocally compact group whoch is dense in another topological group $\tilde{G}$. Let R_t and L_t be the right and the left actions of the group G on $\tilde{G}$. Consider the set of $G-$quasi-invariant measures on $\tilde{G}$:

$$M^S(\tilde{G},\ G) = \{\mu \mid \mu^{S_t} \sim \mu,\ t \in G\},\ {}^SM(\tilde{G},\ G) = \{\mu \mid \mu^{S_t} \perp \mu,\ t \in G\},$$

$$E^S(\tilde{G},\ G) = \{\mu \mid \mu \text{ est } G{-}S{-}\text{ergodic}\},\ {}^LM^R(\tilde{G},\ G) = {}^LM(\tilde{G},\ G) \bigcap M^R(\tilde{G},\ G),$$

where $S = R$ or $S = L$. Let us define the analogue of the right regular representation of the group G in $H_\mu = L_2(\tilde{G},\ \mu)$ like usually. I study the following **conjecture**:

1. *The representation $T^{R,\mu} : G \to U(H_\mu)$ is irreducible if and only if* $\mu \in\ {}^LM^R(\tilde{G},\ G) \bigcap E^R(\tilde{G},\ G)$.

2.*Let T^{R,μ_1} and T^{R,μ_2} be two irreducible representations, then $T^{R,\mu_1} \sim T^{R,\mu_2}$ if and only if $\mu_1^{L_t} \sim \mu_2$, $t \in \tilde{G}$.*

Remark. It is possible to interchange R and L.

In [54] I have constructed an analogue of the regular representation of the group of finite upper triangular matrices of infinite order. In this case the Conjecture was formulated by R.S.Ismagilov and I proved it for product Gaussian measures [6], [8] and for product of non-Gaussiam measures in [15]. For the group of interval diffeomorphisms I proved it in [9]. Right regular representation of the group of circle diffeomorphisms was constructed by M.P.Malliavin and P.Malliavin (reference [20] in [9]). In [9] I proved the reducibility of this representation. More precisely I proved that commutant of the left regular representation is generated by abelian group of right rotations (well known situation for commutant of the right regular representation of locally compact group). The decomposition of the left representation gives a two-parameter family (one integer, another positive real) of irreducible nonequivalent representations.

For the Bott-Virassoro group, the central extension of the group of circle diffeomorphisms, the left regular representation $T^{L,\mu}$ was constructed with R.Léandre (Nancy, France) in [22]. We have proved that the representation is reducible. The decomposition of the representation $T^{L,\mu}$ gives the tree-parameter family (one is real, two other are integer) of irreducible nonequivalent representations.

The following construction is more general. Let $\alpha : G \to Aut(X)$ is the Borelian action of the group G on the Borelian space (X, μ), where μ is some measure on X. If $\mu^{\alpha_t} \sim \mu$ for all $t \in G$ one can construct the representation $\pi^{\alpha,\mu,X} : G \to U(L^2(X, d\mu))$ of the group G in the Hilbert space $H = L^2(X, d\mu)$ by the following natural formula

$$(\pi_t^{\alpha,\mu,X} f)(x) = (d\mu(\alpha_t^{-1}(x))/d\mu(x))^{1/2} f(\alpha_t^{-1} x).$$

Let us denote $\alpha(G)' = \{g \in Aut(X) \mid \{g, \alpha_t\} = e \ \forall t \in G\}$.

One can **generalize the Ismagilov conjecture :**

The representation$\pi^{\alpha,\mu,X} : G \to U(L^2(X, d\mu))$ is irreducible

1) $\mu^g \perp \mu \ \forall g \in \alpha(G)' \backslash \{e\}$,

2) the measure μ is G-ergodic.

I have proved this conjecture in [20], [21], [23] for the nilpotent infinite-dimensional group $G = B_0^{\mathbb{N}}$, certain space $X = G_m \setminus B^{\mathbb{N}}$, where G_m, $m \in \mathbb{N}$

is a subgroup of $B^{\mathbb{N}}$ and Gaussian product-measures on X. In the works [26], [58] with S.Albeverio (Bonn, Germany) this conjecture was proved for the solvable infinite-dimensional Borel group $G = Bor_0^{\mathbb{N}}$, certain space $X = G_m \setminus B^{\mathbb{N}}$, where G_m is a subgroup of $Bor^{\mathbb{N}}$ and Gaussian product-measures on X.

In [25] it was proved for inductive limit of the special linear group $G = SL_0(2\infty,\mathbb{R}) = \varinjlim_n SL(2n-1,\mathbb{R})$, certain subspaces X of the space of infinite real matrices $Mat(\infty,\mathbb{R})$ and Gaussian product measures on X.

In [31] we have construct the so-called *quasiregular representations* of the group $B_0^{\mathbb{N}}(\mathbb{F}_p)$ of infinite triangular matrices *with coefficient in a finite field* $\mathbb{F}_p$ and give the criteria of the irreducibility and equivalence of the constructed representations. The new phenomenon is discovered, namely *the Ismagilov conjecture in not valid* in the case of the field $\mathbb{F}_p$. Some natural conditions of irreducibility (additional to 1) and 2)) appears: *3) the projections of the initial measures on any row should not be equivalent with the infinite tensor product of the invariant measures on the same row.*

Another domain of research deals with *von Neamann algebras and factors.* One can prove that von Neumann algebras generated by regular representations of infinite-dimensional groups give example of type I, II_∞ or III_1 factors (accordingly to the properties of considered measures). For the group of upper triangular matrices of infinite order one has type I if and only if no left actions are admissible for a measure [8].

In the work with R.Zekri (Marseille, France), we have proved that if all the left actions are admissible the *von Neumann algebra* $\mathfrak{A}^{R,\mu_b}$, generated by the right regular representation representation *is factor* under certain technical conditions on the measure μ_b if $\mu_b^\Phi \sim \mu_b$ where $\Phi : B^{\mathbb{N}} \to B^{\mathbb{N}},\ \ \Phi(x) = x^{-1}$ [10, 14, 18, 48]. This factor is type III_1 in the case of the group $B_0^{\mathbb{N}}$ (resp. $B_0^{\mathbb{Z}}$) see (resp. [30] with I.Dynov (Bonn, Germany)) if the corresponding measure μ_b is ergodic.

In [13] some condition of the equivalence $\mu_b^\Phi \sim \mu_b$ of the measure μ_b defined on the group $B_0^{\mathbb{N}}$ were established.

An extension of this work consists of study of semi-direct product of von Neumann algebra by infinite-dimensional groups. This semi-direct product may by defined by analogy with locally compact case using analogue of the regular representations constructed in [6] and [8].

Concerning representation theory of the *braid group and of the quantum groups* we have construct in [33] with S.Albeverio (Bonn, Germany) a

$\left[\frac{n+1}{2}\right]+1$ parameters family of irreducible representations of the braid group B_3 in arbitrary dimension $n \in \mathbb{N}$, using a $q-$deformation of the Pascal triangle. This construction extends in particular results by S.P. Humphries (2000), I. Tuba and H. Wenzl (2001), E. Ferrand (2005). There is a striking connection [34] of these representations of B_3 and a highest weight modules of the *quantum group* $U_q(\mathfrak{sl}_2)$, a one-parameter deformation of the universal enveloping algebra $U(\mathfrak{sl}_2)$ of the Lie algebra $\mathfrak{sl}_2$.

I expect also study of $p-$adic infinite-dimensional groups in particular constructing the Haar measure on the group.

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[31] Quasiregular representations of the group of infinite triangular matrices with coefficient in a finite field (in preparation), 68 p.

[32] Quasi-invariant measures and irreducible representations of the inductive limit of the special linear group (in preparation), 30 p.

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[33] $q-$Pascal's triangle and irreducible representations of the braid group B_3 in arbitrary dimension, arXiv:math.QA(RT)/0803.2778v2. (co-author S.Albeverio, to be submitted in Adv. in Math.) 80 p.

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Proceedings of conferences:

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