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MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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Probability measures on groups

10.11. bis 16.11.1985

An der achten Tagung über Wahrscheinlichkeitsmaße auf Gruppen nahmen 38 Teilnehmer aus dem In- und Ausland teil. Tagungsleiter waren die Herren H. Heyer (Tübingen) und L. Schmetterer (Wien).

Durch fünf einstündige Übersichtsvorträge über aktuelle Forschungsschwerpunkte wurde die Tagung inhaltlich gegliedert. Es wurden dabei neue Entwicklungen aus den folgenden Gebieten zusammengefaßt:

- Irrfahrten auf Graphen,
- zentrale Grenzwertsätze für Produkte zufälliger Matrizen,
- stabile Maße auf Gruppen und Vektorräumen,
- Zufallsfelder auf nichtabelschen lokalkompakten Gruppen,
- der Begriff der Entropie beim Studium von Irrfahrten auf lokalkompakten Gruppen.

In weiteren 27 Einzelvorträgen stellten die Teilnehmer ihre Forschungsergebnisse zur Diskussion. Neben den schon erwähnten Gebieten standen dabei vor allem Fragestellungen der Potentialtheorie auf Gruppen, homogenen Räumen und Graphen, wahrscheinlichkeitstheoretische Anwendungen und Struktur von Hypergruppen, neue Entwicklungen im Zusammenhang mit dem Einbettungsproblem sowie Anwendungen in der Theorie stochastischer Differentialgleichungen und in der Quantenstochastik im Mittelpunkt des Interesses.

Wie auch in früheren Jahren ist geplant, in einem Proceedingsband, der im Laufe des Jahres 1986 in der Reihe "Springer Lecture Notes in Mathematics" erscheinen soll, die im folgenden nur kurz zusammengefaßten Beiträge zu publizieren.

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Vortragsauszüge

M. BABILLOT

Semi-markovian chains and renewal theory for random walks on groups

We are given a homogeneous Markov Chain on a product space $X \times \mathbb{R}^d$ of which the transition kernel is invariant under translations on the second coordinate. When X reduces to a point this is a random walk on $\mathbb{R}^d$. In this case Spitzer (1966) gave asymptotic statements for the potential kernel, when these chains are transient. We describe the asymptotic values of the potential kernel for a transient semi-markovian chain if it is "strongly" ergodic on X. This allows to compute the Martin boundary for random walks on compact extensions of $\mathbb{R}^d$.

P. BAXENDALE

Convolution semigroups of measures on the diffeomorphism group

If M is a compact smooth manifold then the solutions of an M-valued stochastic differential equation may be pieced together to give a stochastic flow $(\xi_t : t \geq 0)$ of diffeomorphisms of M. If μ_t denotes the law of ξ_t then $(\mu_t : t \geq 0)$ forms a convolution semigroup satisfying the condition $\mu_t(G \setminus U) = o(t)$ for all neighbourhoods U of I in $G := \mathrm{Diff}(M)$. It turns out that all such semigroups arise from solutions of stochastic differential equations so long as infinite-dimensional white noise is allowed. A brief mention was made of the way in which Lyapunov exponents can influence the behaviour of the flow as $t \to \infty$.

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C. BERG

Hoeffding inequalities and Schur increasing functions

Let $(S,+)$ be an abelian semigroup with zero element. A function $\psi: S \mathbb{R}$ is said to satisfy Hoeffdings inequality of order n if $\int \psi \, d\bar{\mu}^{*n} \leq \int \psi \, d\mu_1 * \ldots * \mu_n$ for all n-tupels of probability measures μ_j on S with finite support and $\bar{\mu} := \frac{1}{n}(\mu_1 + \ldots + \mu_n)$.
Recent results of Berg, Christensen and Ressel were mentioned concerning the sets H_n $(n=2,3,\ldots)$ of functions satisfying Hoeffdings inequality of order n. Also the cone S_n of Schur increasing functions of order n was introduced: $\psi \in S_n$ iff $\int \psi \, d\nu_1 * \ldots * \nu_n \leq \int \psi \, d\mu_1 * \ldots * \mu_n$ for every $(\mu_1, \ldots, \mu_n)$, where $(\nu_1, \ldots, \nu_n) = (\mu_1, \ldots, \mu_n)\,\Omega$ and Ω is a doubly stochastic nxn matrix.

Theorem 1: If S is 2-divisible then $S_n = H_n$ is the cone of negative definite functions for all $n \geq 2$.

Theorem 2 (Bisgaard): For $S = \mathbb{N}_0$, $k \geq 3$ there exists $\psi \in \bigcap_{n \geq k+1} H_n \setminus H_k$.

M.S. BINGHAM

Limit theorems for approximate martingale arrays on locally compact abelian groups

Let G be a locally compact second countable abelian group with dual $\hat{G}$ and let g be a local inner product on $G \times \hat{G}$. Suppose that $(S_{nj}, F_{nj} : 1 \leq j \leq k_n, n \geq 1)$ is an adapted G-valued triangular array with differences (X_{nj}) and that the filtrations are nested (i.e. $F_{nj} \subset F_{n+1\,j}$ for all n,j). Let $\Phi: \hat{G} \times \Omega \to \mathbb{R}$ be a random continuous nonnegative quadratic form.

Theorem: Assume that $P(X_{nj} \notin N$ for some $j) \to 0$ as $n \to \infty$ for every neighbourhood N of e in G and that, for every $y \in \hat{G}$,
$\sum_{j=1}^{k_n} |E(g(X_{nj}, y) \mid F_{n\,j-1})| \to 0$ in probability (appr. martingale cond.)
and $\sum_{j=1}^{k_n} g(X_{nj}, y)^2 \to \Phi(y)$ in probability.

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Then, for every $A \in F$ with $P(A)>0$, the conditional distribution of $S_{n\,k_n}$ given A converges weakly to the mixture of Gaussian distributions with characteristic function $y \to E(\exp(\frac{-\Phi(y)}{2})|A)$.

W.R. BLOOM

Idempotent measures on commutative hypergroups

The characterization of idempotent probability measures on commutative hypergroups is well-known: they are given by the normalized Haar measures of compact subhypergroups. In this talk properties of the restrictions of characters to subhypergroups were indicated. These are used to characterize the characters γ and compact subhypergroups H such that $\gamma\omega_H$ is an idempotent by the condition $|\gamma| = 1$ on H. An example of a character γ and a subhypergroup H is given such that $\gamma\omega_H$ is no idempotent.

P. BOUGEROL

Survey talk: Central limit theorems for products of random matrices

Let $(x_n : n \geq 1)$ be a Markov chain on a space B and M an application from B into the space of dxd-matrices. In several cases central limit theorems for $(x_n, S_n : n \geq 1)$ are given (where $S_n = M(x_n)M(x_{n-1})\ldots M(x_1)$):

1. (compact case): the matrices $|\det M(x)|^{-1/d}\, M(x)$ are contained in a compact subsemigroup,
2. (irreducible case): the matrices $M(x)$ operate irreducibly,
3. (nilpotent case): the matrices $M(x)$ are upper triangular with 1 in the diagonal.

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Harris recurrent w.r.to σ) or every $x \in X$ is transient (and the potential of every compact is bounded). The characterization of transience is given for the following classes:

1. polynomial hypergroups,
2. the dual spaces of compact symmetric spaces,
3. Sturm-Liouville hypergroups with $\varrho > 0$.

O. GEBUHRER

L^1-ergodic theorems on hypergroups and the Choquet-Deny theorem

L^1-weak and strong ergodic theorems are proved in two different contexts:

1. Commutative locally compact hypergroups having a dual hypergroup with respect to pointwise multiplication.
2. Hermitian locally compact hypergroups of at most polynomial growth.

In the first case, spectral synthesis for points in $\hat{X}$ was already studied; the second case is completely new. The Choquet-Deny theorem appears as a consequence. The results generalize the well-known Derrienic-Lin theorem and prove it by different methods.

P. GERL

Survey talk: Random walks on graphs

Let Γ be a connected, locally finite graph and p a transition probability on it which is assumed to be reversible (i.e. there exist $\lambda_x > 0$ $(x \in \Gamma)$ with $\lambda_x p(x,y) = \lambda_y p(y,x)$) and irreducible. (Γ, p) is called recurrent (transient) if $P(x \to y) = 1$ (<1) - this definition is independent of the choice of x,y.

There are connections with

1. Flows on a graph: (Γ, p) is transient iff there exists a unit flow on Γ of finite energy.

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of probability distributions which are stable in the sense of Hazod with nontrivial idempotent. We consider the semidirect products $\mathbb{R}^d \alpha K$ resp. $\mathbb{H}^d \alpha K$ (where $K \leq SO(d)$ resp. $K \leq U(d)$) which are subgroups of the motion group $D(d)$ and the diamond group $\Delta(d)$. The class of contracting one parameter subgroups is described and those subgroups are selected which are associated with stable laws. Finally the equivalence of stability in the sense of Hazod with the property of being the limit distribution of normed sums of i.i.d. $D(d)$- resp. $\Delta(d)$-valued random variables respecting the infinitesimality condition is showed.

B.J. FALKOWSKI

Lévy-Schoenberg kernels on Riemannian symmetric spaces of noncompact type

The description of so-called Lévy-Schoenberg kernels on homogeneous spaces of the form G/K (where G is a noncompact, connected, semi-simple Lie group with finite centre and K a maximal compact subgroup) is given in terms of certain conditionally positive definite functions on G. A precise description of the Gaussian part is obtained in terms of cohomology. It is shown in particular that the nonnegative solutions of the functional equation $\int \Psi(g_1 k g_2)\, dk = \Psi(g_1) + \Psi(g_2)$ do not adequately describe the Gaussian part. (For $G = Sp(n;1)$ this is known.) Finally $SU(n;1)$ is treated as an example.

L. GALLARDO

Random walks on hypergroups

Let X be a hypergroup with Haar measure σ. A random walk with law $\mu \in M^1(X)$ is a Markov chain with transition kernel $P(x,A) = \delta_x * \mu(A)$. If μ is adapted and spread out a dichotomy theorem can be proved: either every $x \in X$ is recurrent (and the r.w. is

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Y. DERRIENIC

Survey talk: The notion of entropy in the study of random walks on locally compact groups

Let $H(\mu) = -\sum_{x \in G} \mu(x) \log \mu(x)$ (where μ is a probability measure on a discrete group) and $H(f) = -\int f(x) \log f(x)\, dx$ for every density f on a locally compact group G. The subject is the study of $H(\mu^{*n})$ and $H(f^{*n})$. In the talk the relations between entropy and the following notions of probabilistic interest were considered:

1. Central limit theorem. References: Linnik 1959, Csiszar 1964.
2. Harmonic functions. References: Fürstenberg, Avez (1972-76).
3. Boundaries. References: Fürstenberg, Versik-Kaimanovic (1979-1983), Lechappier (1985).
4. Law of large numbers. References: Guivarc'h (1980), Fürstenberg (1970).

S.G. DANI

Dynamics of boundary actions and stochastic harmonic functions

It is shown that there exist probability measures μ on $SL(n,\mathbb{Z})$ $(n \geq 3)$ such that the functional equation $f(x) = \int f(xg)\, d\mu(g)$ for $x \in \mathbb{R}^n$ admits only solutions which are a.e. constant; on the other hand for n=2 there always exist nontrivial solutions.

If μ is spread out on $SL(n,\mathbb{R})$ $(n \geq 3)$ then the C*-algebra of all bounded μ-harmonic l.u.c functions has exactly 2^{n-1} closed subalgebras invariant under the action of any subgroup containing $SL(n,\mathbb{Z})$ or any other lattice in $SL(n,\mathbb{R})$. Finally these results are applied in ergodic theory to prove non-equivalence of various actions of lattices in Lie groups.

T. DRISCH

Stable laws on the motion and diamond groups

The aim of this talk is the presentation of the first examples

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T. BYCZKOWSKI

Random series and seminorms

Let E be a complete separable metric vector space and q be a lower semicontinuous seminorm. Suppose that $\sum_i X_i$ is an a.s. convergent series with symmetric and independent E-valued components. Assuming that $q(\sum_i X_i) < \infty$ a.s. it was shown that the series $\sum_i X_i$ converges a.s. in q if for every $\varepsilon > 0$ $P(q(\sum_i X_i) < \varepsilon) > 0$. A more general version of the Itô-Nisio theorem can be derived from this result. It was also shown that if $Y = \sum_i X_i$ converges a.s. in q and $X_i = a_i x_i$, where a_i are absolutely continuous real random variables and $x_i \in E$, then the distribution of q(Y) is absolutely continuous. Results of this type are also true for Y being a symmetric p-stable random vector $(0<p<2)$.

H. CARNAL

Lévydarstellung stabiler Verteilungen

Lévy (1935) hat für die Zufallsvariable X mit einer stabilen (nichtnormalen) Verteilung folgende Reihendarstellung gefunden: $X = \sum_{j=1}^{\infty} (\Gamma_j^{-1/\alpha} Y_j - b_j)$, wobei Γ_j die Sprungzeiten eines Poisson-Prozesses, $Y_j \in \{-1,1\}$ und $b_j \in \mathbb{R}$ Zentrierungskonstanten sind; die Y_j sind untereinander und von dem Poisson-Prozess unabhängig und identisch verteilt. Diese Darstellung kann man auch für (Operator-)stabile Verteilungen auf $\mathbb{R}^d$ gewinnen, wobei Y_j nun Werte auf einem Ellipsoid annimmt. Für stabile Verteilungen auf einer nilpotenten, einfach zusammenhängenden Lie-Gruppe ist die Reihe durch Summanden zu ergänzen, welche den Termen in der Campbell-Hausdorff-Formel entsprechen. Die Darstellung erlaubt Charakterisierungen des Anziehungsbereiches einer stabilen Verteilung.

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2. Reproducing kernels: (Γ,p) is transient iff there exist $C_x>0$ such that $|f(x)| \leq C_x \|f\|_D$ for all f of finite support.

3. Eigenvalues of the Laplace operator: Dodziuk (1984).

4. Isoperimetric inequalities: see Varopoulos.

W. HAZOD

Survey talk: Stable measures on groups and vector spaces

A convolution semigroup $(\mu_t : t \geq 0)$ is called stable w.r.t. a continuous group $(\tau_t : t>0)$ of automorphisms of the group resp. the vector space if $\tau_s(\mu_t) = \mu_{st}$ $(s,t>0)$. Stable measures on finite dimensional vector spaces are introduced by Sharpe and studied by K. Schmidt, Hudson, Mason, Luczak and Siebert. The case of Banach spaces is treated by Krakowiak, Jajte and Jurek. In the case of locally compact groups it is shown that stable measures are allways concentrated on compact extensions of nilpotent Lie groups. Therefore the theory of stable measures on $\mathbb{R}^d$ can be used. This allows to find a desintegration of the Lévy measure into measures concentrated on orbits $\{\tau_t x : t>0\}$. Finally an intrinsic definition of stability is given which allows - at least for full measures - the description of the domain of attraction independently of the automorphism group.

F. HIRSCH

Density of Wiener functionals and applications to stochastic differential equations

General results about the absolute continuity with respect to the Lebesgue measure on $\mathbb{R}^1$ of certain image measures are applied to the Dirichlet space $\mathbb{D}$ associated to the Ornstein-Uhlenbeck semigroup on the Wiener space: if $u \in \mathbb{D}^1$ and $\Gamma(u,u)$

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is the matrix $(\Gamma(u_i,u_j):1\leq i,j\leq l)$ (where Γ is the so called "opérateur carré de champs") the image measure by u of $\det[\Gamma(u,u)]\cdot m$ (where m is the Wiener measure) is absulutely continuous w.r.t. λ^l. Consequences are drawn for the absolute continuity of conditional laws of solutions of stochastic differential equations with Lipschitz coefficients.

A. JANSSEN

A dichotomy result for measures on $\mathbb{R}^{\mathbb{N}}$

Let G be a locally compact group and P and Q probability measures on the countable product $G^{\mathbb{N}}$. Assume that the finite dimensional marginal distributions of P are absolutely continuous w.r.t. the marginal distributions of Q. The question is treated whether $P\ll Q$ or $P\perp Q$. First an extension of Kakutani's theorem is proved which can be used to compare product measures with more general measures. For example product measures can be compared with the following measures and the dichotomy $P\ll G$ or $P\perp Q$ is proved for Gaussian measures, infinite convolution products and exchangeable measures.

E. KANIUTH

Ergodic and mixing properties of measures on locally compact groups

Let G be a locally compact abelian group, Γ its dual group and μ a bounded complex valued Borel measure on G. The following characterizations of mixing and ergodic properties of μ in terms of $\hat{\mu}$ are well-known:

1. $\mu*f=f$ for $f\in L^\infty(G)$ implies f=const. iff $\hat{\mu}(\gamma)\neq 1$ for $\gamma\in\Gamma\setminus\{1\}$.
2. Suppose that $\|\mu^{*n}\|\leq c$ for $n\geq 1$ and let $I_o:=\{f\in L^1(G):\int f(x)dx=0\}$. Then $\|\mu^{*n}*f\|_1\to 0$ for all $f\in I_o$ iff $|\hat{\mu}(\gamma)|<1$ for $\gamma\in\Gamma\setminus\{1\}$.

Using recent concepts of non-commutative harmonic analysis it turns out that 1. and 2. are true at least for central measures

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μ on groups G of polynomial growth and with symmetric L^1-algebra.

F. KINZL

Gleichverteilung der Folge der Faltungspotenzen eines Wahrscheinlichkeitsmaßes auf lokalkompakten Halbgruppen

Es sei μ ein Wahrscheinlichkeitsmaß auf einer lokalkompakten Halbgruppe S. Es wird das Problem der Konvergenz der Folge $\mu^{*n}-\delta_x*\mu^{*n}$ für $x\in S$ bezüglich der Normtopologie und der schwachen $*$-Topologie studiert. Zunächst wird gezeigt, daß für alle x aus dem Zentrum von S $\lim \|\mu^{*n}-\delta_x*\mu^{*n}\| = 0$ oder 2 ist. Im weiteren wird untersucht, unter welchen notwendigen und hinreichenden Bedingungen die Folge $(\mu^{*n}:n\geq 1)$ asymptotisch gleichverteilt (bzw. schwach a.g.) ist, d.h. $\mu^{*n}-\delta_x*\mu^{*n}\to 0$ für alle $x\in S$ in der Normtopologie (bzw. der schwachen $*$-Topologie) gilt. Dabei zeigt sich, daß die Konvergenz der Folge (μ^{*n}) eine entscheidende Rolle spielt.

J. KISYŃSKI

On jumps of paths of Markov processes

Let $(X_t:t\geq 0)$ be a Markov process on a metric space S with r.c. l.l. paths, such that $P_x[X_0=x]=1$ for $x\in S$ and that the function $x\to P_x[X_t\in B]$ is Borel for $t\geq 0$ and each Borel set $B\subset S$. Denote by $(T_t:t\geq 0)$ the corresponding semigroup in the space of bounded Borel functions on S. Let (f,g) be any pair of nonnegative, bounded, continuous functions such that g is in the domain of the the weak infinitesimal generator G_w of T, and that $\inf\{\mathrm{dist}(x,y):f(x)g(y)>0\}>0$. Then

$$E_x\Big[\sum_{0<u\leq t} f(X_{u-})g(X_u)\Big] = \Big[\int_0^t T_u(f\cdot G_w g)\,du\Big](x) \quad \text{for } x\in S \text{ and } t>0.$$

The above formula is applied to the study of paths of the (Feller)

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process on $[0,\infty]$ with infinitesimal generator G defined by $D(G)=\{g\in C^2[0,\infty]: g''(0)+a\,g'(0)=a\,\mu(g)\}$, $G(g)=\frac{1}{2}g''$, where $a\geq 0$ and $\mu\in M^1(0,\infty]$.

G. LETAC

<u>The various Cauchy types of distributions in $\mathbb{R}^d$, and the functions which preserve them</u>

If G is a subgroup of the affine group A of $\mathbb{R}^d$ and μ is a probability measure on $\mathbb{R}^d$, $G\mu$ is called the G-type of μ. For instance if $\gamma(dx)=K_d\cdot(1+\|x\|^2)^{-\frac{d+1}{2}}\cdot dx$, $A\gamma$ is called the projective Cauchy type; if $\gamma'(dx)=K'_d\cdot(1+\|x\|^2)^{-d}\cdot dx$ and S is the group of affine multitudes, $S\gamma'$ is called the conformal Cauchy type. If an A-type is preserved by $x\to(\frac{x_1}{x_d},\dots,\frac{x_{d-1}}{x_d},\frac{1}{x_d})$ it must be the projective Cauchy type (Meyer, Knight, 1974). If an S-type is preserved by $i:x\to\|x\|^{-2}\cdot x$ it must be the conformal Cauchy type (Dunau, Sénateur). It is shown that if $F:\mathbb{R}^d\to\mathbb{R}^d$ preserves the conformal Cauchy type, then either $F\in S$ or $i\circ F\in S$ $(d\geq 2)$.

M. MC CRUDDEN

<u>Factor compactness of certain probability measures on Lie groups</u>

The following theorem is proved:

Let G be a connected, semisimple Lie group with finite centre, let $\mu\in M^1(G)$ and suppose that the closed subgroup generated by supp(μ) contains a maximal compact subgroup.

Then

$F(\mu,G):=\{\lambda\in M^1(G):$ there exists $\nu\in M^1(G)$ s.t. $\nu*\lambda=\lambda*\nu=\mu\}$

is a compact subset of $M^1(G)$.

Discussions with S.G. Dani during the conference seem likely to lead to an improvement of this result.

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H. RINDLER

Uniform distribution in solvable groups

It is proved (joint work with V. Losert, K.H. Gröchenig) that in nilpotent groups every Hartman-unidistributed sequence is unitary uniformly distributed (with respect to infinitesimal representations). For the motion group on the plane and for the Mautner-group these two concepts are different, but for solvable analytic groups, such that all roots of the Lie-algebra are purely imaginary (i.e. groups of exponential type) the two concepts coincide. It is shown that there exist two 6-dimensional solvable groups such that the set of roots of the Lie-algebras coincide but that in one of them every u.d. sequence is u.u.d. but not in the other. Finally the concept of a projective uniform distribution is introduced and some results are presented which seem to be unexpected at the first view.

M. SCHÜRMANN

*-bialgebras and quantum stochastic increment processes

Combining a lemma on finite-dimensional cogebras and the fundamental theorem on cogebras, one gets a new proof of a well-known theorem on negative- and positive-definite linear functionals on the coefficient algebra of a compact group. An algebraic theory of quantum stochastic processes of independent and stationary increments over a *-bigebra can be developed. There is (up to equivalence) a one-to-one correspondence between these processes and conditionally positive linear functionals vanishing at the unit element.

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G.J. SZÉKELY

Haar measures: recent results

It is shown in the talk that a sufficient condition for a semigroup to be representable as a convolution semigroup of probability measures on some locally compact group is the following: all elements of the semigroup are idempotents. Furthermore the problem is posed under which conditions on a Borel subset A of a locally compact group the uniform distribution on A admits a convolution square root. A sufficient condition is the following: A is a compact subgroup.

K. URBANIK

Compactness, medians and moments

Let $\circ$ be a generalized convolution with characteristic exponent $\varkappa$ and T_a the scale change $x \to ax$. A probability measure μ has the compactness property if there exists a sequence of positive numbers a_n such that $\{T_{a_n}\mu^{\circ n}\}$ is conditionally compact and δ_0 is not its cluster point. Let $M(\mu)$ the greatest median of μ, $N_p(\mu)=(\int_0^\infty x^p\,\mu(dx))^{1/p}$, $l_*(\mu) = \underline{\lim}\ M(\mu^{\circ 2n})/M(\mu^{\circ n})$, $l^*(\mu) = \overline{\lim}\ M(\mu^{\circ 2n})/M(\mu^{\circ n})$ and $K_p(\mu) = \overline{\lim}\ N_{2p}(\mu^{\circ n})/N_p(\mu^{\circ n})$ for $\mu \neq \delta_0$. Then for $\mu \neq \delta_0$ the following conditions are equivalent:

(i) μ has the compactness property,

(ii) $l^*(\mu) < \infty$, (iii) $K_p(\mu)<\infty$ for an index $p<\varkappa$.

W. V. WALDENFELS

Algebraische zentrale Grenzwertsätze

Algebraisiert man den Grundgedanken des zentralen Grenzwertsatzes und des schwachen Gesetzes der großen Zahlen, läßt die Positivitätsbedingung für Wahrscheinlichkeitsmaße

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außer acht und betrachtet gleichzeitig die Struktur $\mathbb{Z}_2$-graduierter Algebren, so gelangt man zu einer Hierarchie zentraler Grenzwertsätze: Gesetz der großen Zahlen - zentraler Grenzwertsatz - neuer zentraler Grenzwertsatz, der unter der Annahme der Positivität trivial wird, u.s.w. Im antikommutativen Falle erhält man Konvergenz gegen Graßmannzahlen.

M.E. WALTER

Duality theory for groups and algebras

The probability measures on a group generate a Banach algebra known as the measure algebra. A general duality theory for a large class of Banach algebras which includes these group measure algebras as well as the algebra of complex nxn-matrices will be given. This duality theory generalizes the classical Pontryagin-Van Kampen duality for locally compact abelian groups. Furthermore there are applications to finite groups, matrices and certain applications in physics.

W. WOESS

Martin boundaries of random walks: ends of groups and trees

Consider transient random walk $(X_n : n \geq 1)$ on an infinite tree T whose nonzero transition probabilities are bounded from below by some positive constant. Suppose that X is uniformly irreducible and has bounded step legths. It is shown that the Martin boundary of X coincides with the space Ω of all ends of T (or, equivalently, of the graph). This yields a boundary representation theorem on Ω for all positive eigenfunctions of the transition operator, and a nontangential Fatou theorem which describes the boundary behaviour. These results apply to

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finitely supported random walks on groups whose Cayley graphs admit a uniformly spanning tree.

K. YLINEN

Survey talk: Random fields on noncommutative locally compact groups

Random fields on a locally compact group G are studied abstractly as functions $\varphi: G \to H$ where H is a Hilbert space. In case G is compact or a separable type I group, Yaglom's representation theory is available for homogeneous random fields, but in more general situations the emphasis is on the use of the group C*-algebra C*(G) and its bidual W*(G). Weakly continuous hemihomogeneous random fields φ are studied as Fourier transforms of bounded linear operators $\Phi: C^*(G) \to H$. The results pertain, e.g., to the relation between the homogeneity properties of φ and the orthogonal scatteredness of Φ^{**}, dilation theory (using the Grothendieck-Pisier-Haagerup inequality), and ergodic theory.

HM. ZEUNER

One dimensional hypergroups

Let X be one of the spaces $\mathbb{R}$, $\mathbb{T}$, $[0,1]$ and $\mathbb{R}_+$ with the usual topology and provided with a hypergroup operation $*$. It is proved that (up to isomorphy) in the cases $X=\mathbb{R}$ and $X=\mathbb{T}$ only the usual convolution coming from the group operation is possible. In the other cases, however, quite a lot of nonisomorphic hypergroup structures can be constructed (e.g. the Chébli-Trimèche structures). It is proved that every hypergroup on $\mathbb{R}_+$ or $[0,1]$ is hermitian and 0 is the neutral element in both cases. Furthermore it can be proved that - after homeomorphic

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modification - the following identities can be obtained:

$\min \operatorname{supp}(\delta_x * \delta_y) = |x-y|$ and $\max \operatorname{supp}(\delta_x * \delta_y) = x+y$

for all $x,y \in \mathbb{R}_+$ (resp. all $x,y \in [0,1]$ such that $x+y \leq 1$).

An application of these results is the characterization of all hypergroups on $\mathbb{R}_+$ admitting stable measures in the sense of Hazod.

<u>Berichterstatter:</u> Hansmartin Zeuner

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