Topics in Mathematical Physics

ICM 2018 Satellite Conference

São Paulo, Brazil - July 26-31, 2018

Book of Abstracts

Organization

We, from the Local Organization Comittee, would like to thank all of our sponsors.

São Paulo Research Foundation
http://www.fapesp.br/en/

Coordination for the Improvement of Higher Education Personnel
http://www.capes.gov.br/

Center of Excellence Severo Ochoa

Basque Center for Applied Mathematics
http://www.bcamath.org/en/

Institute of Physics, University of São Paulo
http://portal.if.usp.br/ifusp/en

Institute of Mathematics and Statistics, University of São Paulo
https://www.ime.usp.br/en

INSTITUTE OF PHYSICS - USP

Mapa do Transporte Metropolitano

Metropolitan Transport Network

Legenda *Legend*

1	**Linha 1 · Azul** *Line 1-Blue*	METRÔ
2	**Linha 2 · Verde** *Line 2-Green*	METRÔ
3	**Linha 3 · Vermelha** *Line 3-Red*	METRÔ
4	**Linha 4 · Amarela** *Line 4-Yellow*	VIAQUATRO
5	**Linha 5 · Lilás** *Line 5-Lilac*	METRÔ
7	**Linha 7 · Rubi** *Line 7-Ruby*	CPTM
8	**Linha 8 · Diamante** *Line 8-Diamond*	CPTM
9	**Linha 9 · Esmeralda** *Line 9-Emerald*	CPTM
10	**Linha 10 · Turquesa** *Line 10-Turquoise*	CPTM
11	**Linha 11 · Coral** *Line 11-Coral*	CPTM
11	**Linha 11 · Coral - Expresso Leste** *Line 11-Coral - East Express*	CPTM
12	**Linha 12 · Safira** *Line 12-Sapphire*	CPTM
	Linha de Ônibus Especial *Special Bus Line*	CPTM
	Expresso Turístico *Touristic Express*	CPTM
	Ponte ORCA - tarifada *Orca Shuttle Service*	EMTU
	Corredor Metropolitano de Ônibus ABD *ABD Metropolitan Bus Corridor*	EMTU
	Terminal Metropolitano de Ônibus *Metropolitan Bus Terminal*	

	Estação *Station*
	Integração - gratuita *Integration - Free Interchange*
	Integração - tarifada *Integration - Paid Interchange*
	Integração - gratuita: Horário Especial (veja no site: METRÔ/CPTM) *Integration - Free Interchange during off-peak hours (see website: METRÔ/CPTM)*
	Estações com elevador *Station with elevator*
	Terminal Rodoviário *Road Terminal*
	Bicicletário *Bike Parking Terminal* — **Paraciclos** *Bike Attaching Post*
	Bicicletário com empréstimo de bicicleta *Bike Parking & Rental Terminal*
FÁCIL	**Estacionamento de Carro Integrado** *Integrated Car Parking*
FÁCIL	**Estacionamento de Carro Integrado/ Paraciclos** *Integrated Car Parking/ Bike Attaching Post*

Informações úteis *Useful Information*

CPTM	www.cptm.sp.gov.br	0800 055 0121
EMTU	www.emtu.sp.gov.br	0800 724 0555
METRÔ	www.metro.sp.gov.br	0800 770 7722
VIAQUATRO	www.viaquatro.com.br	0800 770 7100

Consulte no site das empresas os horários de funcionamento das estações e transferências entre linhas.
Please address the websites of the metropolitan transport companies for stations service hours and line interchange information.

CPTM EMTU METRÔ

GOVERNO DO ESTADO SÃO PAULO
Secretaria dos Transportes Metropolitanos

Topics in Mathematical Physics

IFUSP, São Paulo, from 26/07 to 31/07
Auditorium Abrahão de Moraes

PROGRAM

Time	Thu, 26	Fri, 27	Sat, 28	Sun, 29	Mon, 30	Tue, 31
08:30 - 09:30	Registration					
09:00 - 09:30	Opening Cerimony	**Christina Goldschmidt**	**Philippe Thieullen**	**Free Discussions**	**Marco Merkli**	**Paulo Varandas**
09:30 - 10:00	**Brian Marcus**					
10:00 - 10:30		**Izabella Stuhl**	**Daniel Coronel**		**Ricardo Correa**	**Mark Piraino**
10:30 - 11:00	Coffee Break	Coffee Break	Coffee Break		Coffee Break	Coffee Break
11:00 - 12:00	**Artur Lopes**	**Christof Külske**	**Juan Rivera-Letelier**		**Miguel Ballesteros**	**Jairo Bochi**
12:00 - 13:00	**Aernout van Enter**	**Luca Avena**	**María Isabel Cortez**		**Maximilian Duell**	**Albert Fisher**
13:00 - 14:30	Lunch	Lunch	Lunch at Senzala Restaurant		Lunch	Lunch
14:30 - 15:00	**Klaus Fredenhagen**	**Arnaurd Le Ny**			**Jean-Marie Barbaroux**	
15:00 - 15:30						
15:30 - 16:00	**Edgardo Stockmeyer**	**Satoshi Handa**			**Marcos Brum**	
16:00 - 16:30		**Eric O. Endo**			**Krerley Oliveira**	
16:30 - 17:00	Coffee Break	**Coffee Break + Poster**			Coffee Break	
17:00 - 18:00	**César R. de Oliveira**	**Benedikt Jahnel**			**Sandro Gallo**	

Welcome

It is a pleasure to welcome you to the ICM 2018 Satellite Conference: Topics in Mathematical Physics and to São Paulo. We wish you a pleasant stay and that you enjoy the conference.

Local Organizing Committee

Lucas Affonso (USP)
João C. A. Barata (USP)
Rodrigo Bissacot (USP)
Eric O. Endo (USP & University of Groningen)
Eduardo Garibaldi (UNICAMP)
Walter de Siqueira Pedra (USP)

Scientific Committee

Luca Avena (Leiden University, the Netherlands)
João C. A. Barata (USP, Brazil)
Rodrigo Bissacot (USP, Brazil)
Sébastien Breteaux (Université de Lorraine, France)
Jean-Bernard Bru (University of the Basque Country & BCAM, Basque Country)
Aernout van Enter (University of Groningen, the Netherlands)
Eduardo Garibaldi (UNICAMP, Brazil)
Frank den Hollander (Leiden University, the Netherlands)
Artur Oscar Lopes (UFRGS, Brazil)
Walter de Siqueira Pedra (USP, Brazil)
Wioletta Ruszel (TU Delft, the Netherlands)
Philippe Thieullen (Université de Bordeaux, France)

Conference's location and Internet Access

Abrahão de Moraes Auditorium
Institute of Physics, University of São Paulo
Rua do Matão, Travessa R, 187 - Cidade Universitária
ZIP-Code: 05508-090. São Paulo - SP, Brazil

e-mail: mathphys.icm2018@gmail.com

Internet Access: Login:SSID TMP-USP, Password:Tw6U59!8

Travel Info

Subway in São Paulo: There are five subway lines in São Paulo, and each one is called by color's names. Line 1 – Blue; Line 2 – Green; Line 3 – Red; Line 4 – Yellow; and Line 5 – Lilac. The ticket is bought at the station, and one way ticket costs R$ 4,00 (only cash).

1. Butantã station – Line 4, Yellow (University of São Paulo)
2. Paulista station – Line 4, Yellow (Paulista avenue)
3. Consolação station – Line 2, Green (Paulista avenue, Hotel La Residence Paulista)

We remark that Consolação station and Paulista station are interconnected.

Bus to reach the venue: From Butantã subway station you can pick up bus lines 8012-10 or 8022-10 –"Cidade Universitária - Metrô Estação Butantã" which stops closest to the venue. The one way ticket costs R$ 4,00 (only cash, and the maximum value of change is R$ 20,00). The bus stop are the following:

(a) Bus line 8012-10: bus stop "IAG" (Institute of Astronomy and Geophysics) at Rua do Matão;

(b) Bus line 8022-10: bus stop "Física"(Institute of Physics) at Rua do Matão.

Since the route of the bus inside the university is long, we recommend the following:

(a) Bus line 8012-10: bus stop "FEA" (Faculty of Economy and Administration), at Av. Prof. Luciano Gualberto. From there, cross the avenue and turn to the right. Follow the sidewalk until you see a stairway to your left, which leads to the Institute of Mathematics and Statistics (IME). Follow the stairway and turn left, going between two IME buildings. Once you reach the roundabout "Praça do Oceanógrafo", go straight up and to your right to reach the Institute of Physics.

(b) Bus line 8022-10: bus stop "FAU" (Faculty of Architecture and Urbanism), at Av. Prof. Luciano Gualberto. This stop is just about in front of the stop FEA above, in the other side of the avenue. Walk to the right of the bus stop along the sidewalk and follow the same instructions as above.

Restaurants at University of São Paulo: There are some options of restaurants near the conference.

1. Restaurant of Physics.

   Address: Rua do Matão, Travessa R, 187 - Institute of Physics (IF-USP).

2. Sweden restaurant.

   Address: Av. Prof. Luciano Gualberto, 908 - Faculty of Economics and Administration (FEA-USP)

   Opening hour: 7:00 to 20:00

Restaurants around University of São Paulo: Vital Brasil Avenue, where the Butantã subway station is situated, has many options of restaurants. We list some of them below.

1. INKAHUASI Ceviche and Peruvian restaurant.

   Address: Av. Vital Brasil, 711 - Butantã

2. Savana - Barbecue and pizza.

   Address: Av. Vital Brasil, 398 - Butantã

3. Padaria Estrela do Butantã - Bakery with lunch and dinner options.

   Address: Av. Vital Brasil, 534 - Butantã

4. Vila Butantan - Several options of restaurants and food trucks.

   Address: Rua Agostinho Cantu, 47 - Butantã

Restaurants around Paulista Avenue: Paulista avenue is one of the most important avenues in São Paulo. With 2.8 km of length and four subway stations (Brigadeiro, Trianon-Masp, Consolação's stations - line 2, Green; and Paulista's station - line 4, Yellow), there are many museums, stores, malls and restaurants. We list some restaurants below.

1. Bovinu's - Barbecue

   Address: Alameda Santos, 2393 - Cerqueira César

2. Conjunto Nacional - Building with stores and restaurants (e.g. Grill Hall, Tenda Paulista, Viena)

   Address: Av. Paulista, 2073 - Consolação

3. Shopping Center 3 - Mall with several options of restaurants and fast food (e.g. Abbraccio, Baked Potato, Divino Fogão, Gendai, Pateo da Luz, Viena)

   Address: Av. Paulista, 2064 - Cerqueira César

4. Shopping Cidade São Paulo - Mall with several options of restaurants and fast food (e.g. Almanara, Andiamo, Madero, KFC, Vivenda do Camarão)

   Address: Av. Paulista, 1230 - Bela Vista

5. Junji Sakamoto - Japanese restaurant

   Address: Av. Paulista, 52 - Bela Vista

6. O vegetariano - Vegetarian food

   Address: R. Dr. Rafael de Barros, 40 - Paraíso

7. Shopping Pátio Paulista - Mall with several options of restaurants and fast food (e.g. Bon Grillê, Braugarten, Galeto's, Ibiza, Hiro)

   Address: R. Treze de Maio, 1947 - Bela Vista

Talks

Luca Avena
Leiden University, the Netherlands

Title: *Network coarse-graining, intertwining and metastability without asymptotics*

Abstract: Given an irreducible Markov process on a finite but large state space, we are interested in constructing a measure-valued Markov process on a small state space describing the evolution of the distribution of the original process on a suitable time scale. This is a classical problem in the theory of metastability, where such a program is usually carried out through a proper limiting procedure (such as low temperature or large volume). Our aim is to avoid limiting procedures, for which we present a novel network coarse-graining framework based on Markov intertwining dualities. We show that, providing "good" solutions for the right intertwining equation exist, a satisfactory answer to the original goal is possible. On the other hand, for interesting examples such as a truly metastable dynamics on a large networks it turns out to be difficult (if not unfeasible) to exhibit explicit good solutions. We hence propose a randomized algorithm (based on certain spanning forests) that provides (depending on the specific model and the associated network size) "approximate good" solutions for the intertwining equation and, as a consequence, for the original problem. We conclude by discussing limitations of our approach and some open problems. Joint work with Fabienne Castell, Alex Gaudilliere and Clothilde Melot.

Miguel Ballesteros
Universidad Nacional Autonoma de Mexico (UNAM), Mexico

Title: *Scattering Theory and Resonances in Quantum Field Theory*

Abstract: We study the leading order contribution of the scattering matrix in models of low-energy quantum field theory, in particular we address the spin-boson model. We prove that the scattering cross section has a bump when the photon energies equal the difference between the ground state energy and the real part of the resonance (we study only scattering processes with one incoming photon and one outgoing photon). The width of the bump is related to the imaginary part of the resonance. This contributes to the understanding, in a mathematically rigorous fashion, of experimental results that have been seen even from the beginning of quantum mechanics.

This is a joint work with: Dirk Deckert (LMU Munich), Jérémy Faupin (Université de Lorraine) and Felix Hänle (LMU Munich).

Jean-Marie Barbaroux
Center of Theoretical Physics, University of Toulon, France

Title: *Van der Waals interaction for pseudo-relativistic atoms and molecules*$^{(*)}$

Abstract: The Van der Waals force between atoms or molecules plays an important role in chemistry, physics and biology. It explains different processes and phenomena from

condensation of water up to shapes of gigantic molecules such as proteins and DNA. A mathematically rigorous computation of the Van der Waals interaction energy was given recently by I. Anapolitanos and I.M. Sigal for nonrelativistic Schrödinger operators. In the present talk, applying a different method, the result is extended to operators with pseudorelativistic kinetic energy. As a result, for both relativistic and non-relativistic cases, we compute higher order corrections to the Van der Waals-London law. The result also contains a proof of exponential decay for ground states of atoms and molecules in the case of relativistic kinetic energy and including permutational symmetries.
(*) The talk is based on a joint work with M. Hartig, D. Hundertmark and S. Wugalter.

Jairo Bochi
Pontificia Universidad Católica de Chile, Chile

Title: *Extremal norms for linear cocycles*

Abstract: In traditional Ergodic Optimization, one seeks to maximize Birkhoff averages. The most useful tool in this area is the celebrated Mañé Lemma, in its various forms. In a joint work with Eduardo Garibaldi, we prove a non-commutative Mañé Lemma, suited to the problem of maximization of Lyapunov exponents of linear cocycles or, more generally, vector bundle automorphisms. More precisely, we provide conditions that ensure the existence of an extremal norm, that is, a Finsler norm with respect to which no vector can be expanded in a single iterate by a factor bigger than the maximal asymptotic expansion rate. Therefore we extend the classic concept of Barabanov norm, which is used in the study of the joint spectral radius. We obtain several consequences, including sufficient conditions for the existence of Lyapunov maximizing sets.

María Isabel Cortez
Universidad de Santiago de Chile, Chile

Title: Algebraic objects associated to aperiodic actions on the Cantor set and their relationships with dynamics.

Abstract: Dimension groups, Topological full groups and Automorphisms groups are algebraic objects that we can define and associate to any aperiodic action of a countable group on the Cantor set. In particular, the Topological full groups are very interesting from the Group Theory point of view and several groups can be seen as subgroups of the Automorphisms groups. However, these objects also determine some dynamical properties of the corresponding Cantor systems. For example, the dimension groups are the algebraic invariant for orbit equivalence, and we can use them in order to find in each orbit equivalence class associated to uniquely ergodic systems, the restriction of a unimodal map on a Cantor invariant set . This is a talk made from several works in collaboration with many co-authors (Paulina Cecchi, Fabien Durand, Constantine Medynets, Samuel Petite, Juan Rivera -Letelier).

Maximilian Duell
Technische Universität München, Germany

Title: *Asymptotic Completeness in Deformed Models of Wedge-local Quantum Field Theory*

Abstract: Wedge locality provides a generalization of the physical notion of causality implemented by local quantum field theory. Motivated by recent successful constructions of non-trivial relativistic wedge-local models also in four-dimensional space-time, we develop multi-particle scattering theory in the general operator-algebraic setting of massive wedge-local quantum field theory. Whereas two-particle scattering in such models has been readily accessible via conventional Haag-Ruelle arguments, an extension to higher particle numbers was so far obstructed due to wedge geometry. We explain how these limitations are overcome in our work via wedge duality. As an example application we briefly discuss explicit Møller operators, multi-particle scattering data, and the property of asymptotic completeness in a large class of wedge-local models obtained via deformations by Lechner et al.

Partially based on arxiv.org/abs/1711.02569 (to appear in CMP).

Aernout C.D. van Enter
University of Groningen, Netherlands

Title: *One-sided versus two-sided points of view*

Abstract: Finite-state, discrete-time Markov chains coincide with Markov fields on $\mathbb{Z}$, (which are nearest-neighbour Gibbs measures in one dimension). That is, the one-sided Markov property and the two-sided Markov property are equivalent.

We discuss to what extent this remains true if we try to weaken the Markov property to the almost Markov property, which is a form of continuity of conditional probabilities. The generalization of the one-sided Markov measures leads to the so-called "g-measures" (a.k.a "chains with complete connection", "uniform martingales",...), whereas the two- sided generalization leads to the class of Gibbs or DLR measures, as studied in statistical mechanics.

It was known before that there exist g-measures which are not Gibbs measures. It is shown here that neither class includes the other. We consider this issue in particular on the example of long-range, Dyson model, Gibbs measures. In our arguments we make use of the phenomenon of entropic repulsion.

(Work with R. Bissacot, E. Endo and A. Le Ny)

Albert Fisher
Institute of Mathematics and Statistics, USP

Title: *Invariant measures for nonprimitive adic transformations*

Abstract: As Vershik says, the dynamics of the odometer transformation is transversal to that of the full shift, as it acts on the stable sets of the shift space; the analogy is to the horocycle flow acting on the stable manifolds of the geodesic flow. This wide-ranging idea extends to subshifts of finite type (SFT), where the odometer is replaced by a Vershik adic

transformation. Measure-theoretically the hyperbolic dynamics of the shift or geodesic flow is very different from the nonhyperbolic transverse dynamics, as there are many invariant measures; by contrast the adic transformation is minimal and uniquely ergodic, with its measure given by a formula related to that for the measure of maximal entropy of the shift: the Parry measure.

Vershik's real insight was that this makes sense for nonstationary combinatorics, where the single 0-1 matrix for an SFT is replaced by a sequence of rectangular nonegative integer matrices, and the graph of the SFT is replaced by a Bratteli diagram. The resulting framework serves to unite a variety of examples from ergodic theory and dynamics, including substitution dynamical systems, cutting-and-stacking constructions, and interval exchange transformations.

Such a matrix sequence is termed primitive if, starting at some time, there exists a future time such that the partial product is strictly positive. Primitivity implies minimality, but unlike in the stationary case, no longer implies unique ergodicity: Keane's counterexample of an interval exchange provides an adic counterexample as well.

The primitive case is now fairly well understood, but things get really interesting in the nonstationary, nonprimitive case, where infinite invariant measures (indeed, infinite on every nonempty open subset) can arise naturally. They are natural in that they are finite when restricted to some sub-Bratteli diagram; these nested diagrams have a geometric interpretation as describing fractal subsets.

In this talk we introduce the subject, presenting a necessary and sufficient condition in the nonstationary, nonprimitive case of finite rank (bounded alphabet size) for such a measure to be finite.

In an application to circle rotations, one nested as the induced map on a Cantor set inside the other, this condition is expressed in terms of the continued fraction expansions of the two rotation numbers.

(joint with Marina Talet)

Klaus Fredenhagen

II. Institut für Theoretische Physik, Hamburg, Germany

Title: *A regular interaction picture for relativistic quantum field theory, and perturbative KMS states*

Abstract: The interaction picture in relativistic quantum field theory is too singular for an application of standard techniques of quantum mechanics and quantum statistical mechanics. This shows up e.g. in infrared divergences in thermal QFT. It is shown that by the use of perturbative algebraic quantum field theory a modified interaction picture can be introduced which is suficiently regular.

Sandro Gallo
Universidade Federal de São Carlos, Brazil

Title: *Non-regular g-measures*

Abstract: Non-regular g-measures can be seen as the counterpart of non-Gibbs measures on $\mathbb{Z}$ when conditioning only on one side. In this context, $\mathbb{Z}$ is interpreted as time rather than space. The starting object is the family of "conditional probabilities of the present given past" which was called g-function by Keane (1972). The g-function has the role of the specification in the statistical physics literature. The main objective of this talk will be to present several basic results concerning the measures compatible with discontinuous g-functions. We will present conditions for existence, uniqueness, and further statistical properties such as concentration bounds and central limit theorems. The talk will be based on results in collaboration with Ricardo F. Ferreira, Frédéric Paccaut and Arnaud Le Ny.

Christina Goldschmidt
University of Oxford, England

Title: *Critical random graphs with i.i.d. random degrees having power-law tails*

Abstract: Consider a graph with label set $\{1, 2, \ldots, n\}$ chosen uniformly at random from those such that vertex i has degree D_i, where $D_1, D_2, \ldots, D_n$ are i.i.d. strictly positive random variables. The condition for criticality (i.e. the threshold for the emergence of a giant component) in this setting is $E[D^2] = 2E[D]$, and we assume additionally that $P(D = k) \sim ck^{-(\alpha+2)}$ as k tends to infinity, for some $\alpha \in (1, 2)$. In this situation, it turns out that the largest components have sizes on the order of $n^{\alpha/(\alpha+1)}$. Building on earlier work of Adrien Joseph, we show that the components have scaling limits which can be related to a forest of stable trees (à la Duquesne-Le Gall-Le Jan) via an absolute continuity relation. This gives a natural generalisation of the scaling limit for the Erdős-Renyi random graph which I obtained in collaboration with Louigi Addario-Berry and Nicolas Broutin a few years ago (extending results of Aldous), and complements recent work on random graph scaling limits of various authors including Bhamidi, Broutin, Duquesne, van der Hofstad, van Leeuwaarden, Riordan, Sen, M. Wang and X. Wang.

This is joint work with Guillaume Conchon-Kerjan (Paris 7).

Benedikt Jahnel
Weierstrass Institute Berlin, Germany

Title: *Attractor properties for irreversible and reversible interacting particle systems*

Abstract: In this talk I will consider translation-invariant interacting particle systems on the lattice with finite local state space admitting at least one Gibbs measure as a time-stationary measure. The dynamics can be irreversible, which allows us to also treat a class of models exhibiting rotational behavior. I will present und discuss conditions under which weak limit points of any trajectory of translation-invariant measures are Gibbs states for the same specification as the time-stationary measure.

Christof Külske
Ruhr-University Bochum, Germany

Title: *Dynamical Gibbs-non Gibbs transitions in the Widom-Rowlinson model in different geometries*

Abstract: We consider the two-color Widom-Rowlinson model under a stochastic colorflip time-evolution. The Widom-Rowlinson model is an equilibrium model for interacting point particles in Euclidean space which shows a provable phase-transition. Moreoever this system of point particles has natural counterparts in different geometries, especially as a lattice system and as a mean-field system. We discuss recent results on dynamical Gibbs-non Gibbs transitions in this context.

Joint work with: Benedikt Jahnel (see reference below), Sascha Kissel (work in progress)

B.Jahnel, C.Külske: The Widom-Rowlinson model under spin flip: Immediate loss and sharp recovery of quasilocality, Ann. Appl. Probab. 27 (2017), pp. 3845–3892.

Arnaud Le Ny
Université Paris-Est, France, and CNRS-Eurandom (F-NL), the Netherlands

Title: *Interfaces states for long-range Ising models*

Abstract: During this talk, we shall review old and recent results concerning interface states for long-range Ising models with polynomially decaying pair-potentials in the phase transition region (low temperature and slow decay). This talk will be based on collaborations with R. Bissacot, E. Endo and A. van Enter (in dimension one) and with L. Coquille, A. van Enter and W. Ruszel (in dimension two).

Artur O. Lopes
Instituto de Matemática, UFRGS, Brazil

Title: *Thermodynamic Formalism for potentials on the Walters' class*

Abstract: P. Walters introduced a class of potentials A on the symbolic space $\{0,1\}^{\mathbb{N}}$. These potentials include the potentials which were previously known as of Hofbauer type. We will present several results on the Thermodynamic Formalism for shift invariant equilibrium states for potentials on the Walters' class. This class provides a rich set of examples where complex behaviour can be observed. We analyze questions related to phase transition, lack of differentiability of the pressure, decay of correlation and renormalization.

Brian Marcus
University of British Columbia, Vancouver, Canada

Title: *Equivalence of relative Gibbs and relative equilibrium measures for actions of countable amenable groups*

Abstract: We formulate and prove a very general *relative* version of the Dobrushin-Lanford-Ruelle Theorem which gives conditions on constraints of configuration spaces over a finite alphabet such that for every absolutely summable relative interaction, every translation-invariant relative Gibbs measure is a relative equilibrium measure and vice versa. Neither implication is true without some assumption on the space of configurations. We note that the usual finite type condition can be relaxed to a much more general class of constraints. By "relative" we mean that both the interaction and the set of allowed configurations are determined by a random environment. The result includes many special cases that are well known. We give several applications including 1) Gibbsian properties of measures of maximal relative pressure which project to a given measure via a topological factor map from one symbolic system to another; 2) Relationship between measures of maximal pressure for a symbolic G-action and measures of maximal relative pressure for the induced H-action on a system determined by a finite set of H-cosets, where H is a subgroup of G; 3) A relativized version of a theorem of Meyerovitch, who proved a version of the Lanford Ruelle theorem which shows that every equilibrium measure on an arbitrary Z^d subshift satisfies a Gibbsian property on interchangeable patterns. This is joint work with Sebastian Barbieri, Ricardo Gomez Aiza, and Siamak Taati.

Marco Merkli
Department of Mathematics and Statistics, Memorial University, Canada

Title: *Metastability due to almost degenerate energies in an open quantum system*

Abstract: We consider a three-level quantum system interacting with a bosonic thermal quantum field (a 'reservoir'). Two energy levels of the system are nearly degenerate but well separated from the third one. The system-reservoir interaction constant is larger than the energy difference of the nearly degenerate levels, but it is smaller than the separation between the latter and the remaining level. We show that the quasi-degeneracy of energy levels leads to the existence of a manifold of quasi-stationary states for the open system dynamics, which exhibits two characteristic time scales. On the first, shorter one, initial states approach the quasi-stationary manifold. Then, on the much longer second time scale, the final, unique equilibrium is reached.

César R. de Oliveira
Federal University of São Carlos, Brazil

Title: *Typical fractal dimensions of spectral measures*

Abstract: For some metric spaces of self-adjoint operators, it will be discussed that the typical behavior has, on top of singular continuous spectrum, extremal values of fractal and dynamical quantities (correlation dimensions, mean return probability exponents, Hausdorff and packing dimensions, and dynamical moment exponents).

Juan Rivera-Letelier
University of Rochester, USA

Title: *Mixing rates of geometric Gibbs states at criticality*

Abstract: For smooth one-dimensional maps, we study mixing rates of geometric Gibbs states at a phase transition. Under a non-uniform hyperbolicity assumption, we show that mixing rates cannot be exponentially fast. We also show that for (real and complex) quadratic maps satisfying a strong non-uniform hyperbolicity assumption, the mixing rates of a Gibbs state can be arbitrarily slow. This is a joint work with Daniel Coronel.

Edgardo Stockmeyer
Institute of Physics, PUC, Chile

Title: *Asymptotic dynamics of certain 2-D magnetic quantum systems*

Abstract: In this talk I will present new results concerning the long time localisation in space (dynamical localisation) of certain two-dimensional magnetic quantum systems. The underlying Hamiltonian may have the form $H = H_0 + W$, where H_0 has dense point spectrum and rotational symmetry and W is a perturbation that breaks the symmetry.
(Joint with: I. Anapolitanos, E. Cardenas, D. Hundertmark, and S. Wugalter)

Phillippe Thieullen
Université de Bordeaux, France

Title: *Non convergence of a 1D Gibbs model at zero temperature*

Abstract: We study the convergence or the non convergence of a 1D one-sided model of Gibbs measures when the temperature tends to zero. The state space is finite with two symbols as in the Ising model. The potential is a family of long range interactions which are Lipschitz or more generally have summability variation. The groud states are reduced to two periodic configurations and possibly an heteroclinic configuration linking the periodic configurations. We prove the convergence of the Gibbs measure at zero temperature in all cases expcepted in the case of the heteroclinic configuration.

This work is a joint work with Rodrigo Bissacot and Eduardo Garibaldi.

Paulo Varandas
Federal University of Bahia (UFBA), Brazil

Title: *Thermodynamic formalism of free semigroup actions*

Abstract: An extension of the classical thermodynamic formalism for the setting of group and semigroup actions face some nontrivial challenges. If, on the one hand, it runs into the difficulty to establish a suitable notion of topological complexity for the action, on the other hand, the existence of probability measures that are invariant by the (semi)group action is a rare event beyond the setting of finitely generated abelian groups. We will report on recent contributions in the context of free semigroup actions. We discuss a suitable notion of measure theoretical entropy for a finitely generated free semigroup action and establish a variational principle when the semigroup is generated by continuous self maps on a compact metric space and has finite entropy. In the case of semigroups generated by Ruelle-expanding maps we will discuss the existence of equilibrium states and describe some of their properties.

Short Talks

Marcos Brum
University of São Paulo, Brazil

Title: *Wavepackets on de Sitter spacetime*

Abstract: We construct wavepackets on de Sitter spacetime, with masses consistently defined from the eigenvalues of an irreducible representation of a Casimir element in the universal enveloping algebra of the Lorentz algebra and analyze their asymptotic behaviour. Furthermore, we show that, in the limit as the de Sitter radius tends to infinity, the wavepackets tend to the wavepackets of Minkowski spacetime and the plane waves arising after contraction have support sharply located on the mass shell.

Daniel Coronel
Universidad Andrés Bello, Chile

Title: *Sensitive dependence of geometric Gibbs measures at positive temperature*

Abstract: In this talk we give the main ideas of the construction of the first example of a smooth family of real and complex maps having sensitive dependence of geometric Gibbs states at positive temperature. This family consists of quadratic-like maps that are non-uniformly hyperbolic in a strong sense. We show that for a dense set of maps in the family the geometric Gibbs states diverge at positive temperature. These are the first examples of divergence at positive temperature in statistical mechanics or the thermodynamic formalism, and answers a question of van Enter and Ruszel. Joint work with Juan Rivera-Letelier.

Eric O. Endo
University of São Paulo, Brazil, and University of Groningen, the Netherlands

Title: *Sigma-finite DLR measures on countable Markov shift*

Abstract: After the seminal paper of Sarig that states the Ruelle-Perron-Frobenius Theorem for countable Markov shifts, we are interested to look for conditions for the shifts and potentials in order to guarantee the equivalence between conformal measures and DLR measures. We already know that these notions coincide in the case of probabilities on Markov shifts with finite alphabets and potentials regular enough (Sarig and Cioletti-Lopes). We consider the natural extension of the notion of DLR measures to the sigma-finite case and show that every conformal measure is a DLR measure. In addition, we investigate when the converse implication is true, showing that this happens when the Markov shifts have the BIP property and when the potentials normalize the Ruelle operator.

Joint work with E. Beltrán (IME-USP) and R. Bissacot (IME-USP).

Satoshi Handa
Hokkaido University, Japan

Title: *The lace expansion for the nearest-neighbor models on the body-centered cubic lattice*

Abstract: This talk is based on the joint work with Yoshinori Kamijima and Akira Sakai. The lace expansion is a powerful tool to show the mean-field behavior (MFB) for many statistical-mechanical models in high dimensions mathematically rigorously. There exists the upper-critical dimension d_c for each statistical-mechanical model and each model shows the MFB above d_c. Historically, Hara and Slade proved the MFB on $\mathbb{Z}^{d\geq 5=d_c+1}$ for nearest-neighbor self-avoiding walk (SAW) and on $\mathbb{Z}^{d\geq 19}$ for nearest-neighbor percolation. Since we believe that $d_c = 6$ for percolation, there were still a gap between 7 and 19. Recently, van der Hofstad and Fitzner proved the MFB on $\mathbb{Z}^{d\geq 11}$ for nearest-neighbor percolation by non-backtracking lace expansion. However, this method is quite technical and not so easy to understand, and also there are still a gap between 7 and 11. In this talk, we consider the body-centered cubic (BCC) lattice $\mathbb{L}^d$ for the nearest-neighbor SAW and percolation. Thanks to good properties of BCC lattice $\mathbb{L}^d$, we can much easily show the MFB on $\mathbb{L}^{d\geq 6}$ for nearest-neighbor SAW and on $\mathbb{L}^{d\geq 9}$ for nearest-neighbor percolation. Time permitting, we will mention the nearest-neighbor oriented percolation on BCC lattice $\mathbb{L}^d$, which is the ongoing project with Lung-Chi Chen and Yoshinori Kamijima.

Krerley Oliveira
Federal University of Alagoas, Brazil

Title: *Equilibrium States, IFS and partially hyperbolic horseshoes*

Abstract: In the first one (`https://goo.gl/XNXEEH`) we prove existence of relative maximal entropy measures for certain random dynamical systems that are skew products of the type $F(x, y) = (\theta(x), f_x(y))$, where θ is an invertible map preserving an ergodic measure $\mathbb{P}$ on a Polish space and f_x is a local diffeomorphism of a compact Riemannian manifold exhibiting some non-uniform expansion. As a consequence of our proofs, we obtain an integral formula for the relative topological entropy as the integral the of logarithm of the topological degree of f_x with respect to $\mathbb{P}$. When F is topologically exact and the supremum of the topological degree of f_x is finite, the maximizing measure is unique and positive on open sets.

In the second setting, we discuss uniqueness of equilibrium states for Partially Hyperbolic Horseshoes studied in a previous article with R. Leplaideur and I. Rios (`https://goo.gl/8LsZVd`). These families of horseshoes have interesting features, as dense sets of segments in its central direction on its non-wandering set. They have heteroclinical cycles and are extensions of the golden shift. From one hand, they have phase transitions for smooth potentials and from the other hand, one expect uniqueness for potentials that are close to zero. We make use of the semiconjugacy to build induced maps conjugated to infinite shifts and obtain explicitly a set of Holder potentials with unique equilibrium state. In collaboration with M. Santos.

Mark Piraino
University of Victoria, Canada

Title: *1-block factors of g measures*

Abstract: The classical method for understanding hidden Markov measures is to realize the measure of a cylinder set in terms of a product of non-negative matrices. In this talk I will present a natural way of extending this idea to 1-block factors of g measures. Using this extension I will explain how to apply cone techniques to show that some standard classes of g measures are closed under projection by fiber-wise mixing factor maps.

Ricardo Correa da Silva
University of São Paulo, Brazil

Title: *Applications of Noncommutative Integration to Perturbations of KMS States*

Abstract: KMS states are very important in quantum statistical mechanics since they describe thermal equilibrium states. It is also important the theory of perturbations of these states, mostly developed by Araki. Unfortunately, Araki's theory is restricted to bounded perturbations.

We will present our progress in extending the theory of perturbations of KMS states using noncommutative L_p-spaces. We will also discuss certain stability property of the domain of the Modular Operator associated to a $\|\cdot\|_p$-continuous state that allows us to define an analytic multiple-time KMS condition and to obtain its analyticity together with some bounds to its norm. Finally, we will discuss how it can be used to extend perturbations to a class of unbounded perturbations.

Izabella Stuhl
Penn State, EUA

Title: *Gibbs measures via Pirogov-Sinai theory for high-density hard-core models on a triangular lattice*

Abstract: The hard-core model has attracted attention for quite a long time; the first rigorous results about the phase transition on a lattice were obtained by Dobrushin in late 1960s. Since then, various aspects of the model gained importance in a number of applications, including Computer Science and Information Theory. We propose a solution for the high-density hard-core model on a triangular lattice. The high-density phase diagram (i.e., the collection of pure phases) depends on arithmetic properties of the exclusion distance D; a convenient classification of possible cases can be given in terms of Eisenstein primes. For two classes of values of D the phase diagram is completely described: (I) when either D or $D/\sqrt{3}$ is a positive integer whose prime decomposition does not contain factors of the form $6k+1$, (II) when D^2 is an integer whose prime decomposition contains (i) a single prime of the form $6k+1$, and (ii) other primes, if any, in even powers, except for the prime 3. For the remaining values of D we offer some partial results. The main method of the proof is

the Pirogov-Sinai theory with an addition of Zahradnik's argument and results by Dobrushin and Shlosman. The theory of dominant ground states is also extensively used, complemented by a computer-assisted argument.
This is a joint work with A. Mazel and Y. Suhov.

Poster

Rogério Alves
Federal University of Ouro Preto, Brazil

Title: *Condensation of the Hard-Sphere gas*

Abstract: An old problem in classical equilibrium statistical mechanics is the rigorous treatment of the phenomenon of condensation. In view of Mayer's theory of condensation, we discuss partial results which determines the singularity closest to the origin of the series expansion of the pressure, in terms of the activity parameter, of the hard-sphere gas. Joint work with R. Bissacot and L. Affonso.

Lissa Campos
University of São Paulo, Brazil

Title: *Algebraic Quantum Field Theory in Singularity Theorems*

Abstract: Within General Relativity, without solving Einstein equations or choosing a matter model, these are strong results that give us information about the geometry of the space time: Singularity Theorems. One way of checking if Singularity Theorems still hold when quantum effects are considered is by approaching the energy condition; since it is well-known that within Quantum Field Theory negative energies must be taken into account. This can be done within Algebraic Quantum Field Theory, a mathematically rigorous formalism that can be applied to curved spacetimes and, in particular, is the formalism for deriving quantum energy inequalities. Inspired by these, Christopher Fewster and Gregory Galloway proved Weakened Singularity Theorems, which show thatsubtle quantum effects do not elude singularities in General Relativity.

Victor Chabu
University of São Paulo, Brazil

Title: *Asymptotic limits of pure quantum states as classical mixtures*

Abstract: Positive linear functionals over a C^* algebra have been discovered to be a convenient way of representing the states of a physical system whose observables are given by the self-adjoint elements of this algebra. This is true either in the classical picture, where one has non-commutative algebras of operators acting on a suitable Hilbert space, or in the classical one, with the abelian algebras of complex-valued functions over an adequate phase space. Functionals defined so always form convex sets, making it possible to distinguish them between those that can be expressed as convex combinations of others, and those that cannot, called by physicists *mixed* and *pure states*, respectively.

If a family of quantum pure states submitted to a smooth potential concentrates to a pure one in the semiclassical limit at a given instant, then necessarily the concentrated state keeps being pure for any time. However, in this poster we exhibit a family of solutions to

the Schrödinger equation whose associated Wigner (semiclassical) measures correspond to pure classical states for $t \leqslant 0$, but split into a mixture of two pure states for $t > 0$. Such a phenomenon may only exist due to the presence of singularities in the potential, and indeed this example is a spin-off of a work in which we study the asymptotic behaviour of systems evolving under conical potentials.

Ricardo Ferreira
Federal University of São Carlos, Brazil

Title: *On discontinuous g-functions*

Abstract: In this work, we present an overview concerning measures compatible with discontinuous $g-$functions. We start introducing some examples of discontinuous $g-$functions and then the existence and uniqueness problems of invariant measure

Sergio Giardino
Universidade do Rio Grande do Sul, Brazil

Title: *Quaternionic quantum mechanics in real Hilbert space*

Abstract: A formulation of quaternionic quantum mechanics ($\mathbb{H}$ QM) is presented in terms of a real Hilbert space. Using a phisically motivated scalar product, we prove the spectral theorem and obtain a novel quaternionic Fourier series. After a brief discussion on unitary operators in this formalism, we conclude that this quantum theory is indeed consistent and can be a valuable tool in the search for new physics.

Josué Knorst
Universidade Federal do Rio Grande do Sul, Brazil

Title: *Quantum Markov Semigroups*

Abstract: We discuss the concepts of Dynamical Semigroups, Quantum Markov Semigroups and their Infinitesimal Generators $\mathcal{L}$. In the context of Quantum Mechanics, we are interested in operators with the complete positivity property. This leads to infinitesimal generators with a property called conditionally completely positive. It's usefull, in this context, to use Kraus representation for completely positive operators on finite dimension. In addiction, we define $\mathcal{L}^*$, the dual of $\mathcal{L}$, which acts on density operators ρ, and discuss about invariant density operators for a Quantum Stochastic Semigroup.

Fernando M.C. Oliveira
Universidade Federal do ABC, Brazil

Title: *Nearly Associative Deformation Quantization*

Abstract: We study several classes of non-associative algebras as possible candidates for deformation quantization in the direction of a Poisson bracket that does not satisfy Jacobi identities. We show that in fact alternative deformation quantization algebras require the Jacobi identities on the Poisson bracket, and under very general assumptions, are associative. At the same time, flexible deformation quantization algebras exist for any Poisson bracket. And in particular, the star products arising from some references in non-geometric flux are even flexibles.

Thiago Raszeja
University of São Paulo, Brazil

Title: *Conformal Measures on Generalized Renault-Deaconu Groupoids*

Abstract: Countable Markov shifts, which we denote by Σ_A for a 0-1 infinite matrix A, are central objects in symbolic dynamics and ergodic theory. The corresponding operator algebras have been introduced by M. Laca and R. Exel as a generalization of the Cuntz-Krieger algebras for the case of an infinite and countable alphabet. By a result of J. Renault, this generalization may be realized as the C*-algebra of the Renault-Deaconu groupoid for a partially defined shift map σ defined on a locally compact set X_A which is a spectrum of a certain C*-algebra. This set X_A contains Σ_A as a dense subset. We introduced the notion of conformal measures in X_A and, inspired by the thermodynamic formalism for renewal shifts on classical countable Markov shifts, we show that there exists a potential f depending on the first coordinate which presents phase transition, in other words, we have existence and absence of conformal measures μ_β for βf for different values of β. These conformal measures, when do exist for some β, satisfy $\mu_\beta(\Sigma_A) = 0$. As a consequence, we have shown the existence of conformal probability measures which are not detected by the classical thermodynamic formalism when the matrix A is not row-finite.

Joint work with R. Bissacot (IME-USP), R. Exel (UFSC) and R. Frausino (IME-USP).

List of participants

1. Lucas Affonso - USP, Brazil
2. José Luiz Alves - UFSC, Brazil
3. Rogério Alves - UFOP, Brazil
4. Luca Avena - Leiden University, the Netherlands
5. Kauê Rodrigues Alves - USP, Brazil
6. Miguel Ballesteros - UNAM, Mexico
7. João C. A. Barata- USP, Brazil
8. Jean-Marie Barbaroux - Université de Toulon, France
9. Elmer R. Calderón Beltrán - USP, Brazil
10. Sébastien Bretaux - Université de Lorraine, France
11. Rodrigo Bissacot - USP, Brazil
12. Jairo Bochi - Pontificia Universidad Católica de Chile, Chile
13. Jean Bernard-Bru - University of the Basque Country & BCAM, Basque Country
14. Marcos Brum - USP, Brazil
15. Luísa Bürgel Borsato - USP, Brazil
16. Rodrigo Augusto Hugo Mafra Cabral - USP, Brazil
17. Lissa Campos - USP, Brazil
18. Victor Chabu - USP, Brazil
19. Daniel Coronel - Universidad Andrés Bello, Chile
20. María Isabel Cortez - Universidad de Santiago de Chile, Chile
21. Maximilian Duell - Technische Universität München, Germany
22. Eric O. Endo - USP, Brazil/ University of Groningen, the Netherlands
23. Aernout van Enter - University of Groningen, the Netherlands
24. Emre Esenturk- University of Cambridge, England
25. Ana Camila Costa Esteves - USP, Brazil
26. Nelson Faustino - UFABC, Brazil
27. Ricardo Ferreira - UFSCar, Brazil

28. Albert M. Fisher - USP, Brazil
29. Klaus Fredenhagen - University of Hamburg, Germany
30. Rodrigo Fresneda - UFABC, Brazil
31. Sandro Gallo - UFSCAR, Brazil
32. Sergio Giardino - UFRGS, Brazil
33. Christina Goldschmidt - University of Oxford, England
34. Satoshi Handa - Hokkaido University, Japan
35. Benedikt Jahnel - Weierstrass Institute for Applied Analysis and Stochastics, Germany
36. Josué Knorst - UFRGS, Brazil
37. Christof Külske - Ruhr-Universität Bochum, Germany
38. Arnaud Le Ny - Université Paris-Est, France
39. José Roberto Lessa - FMU, Brazil
40. Rafael Pereira Lima - USP, Brazil
41. Gabriel Bonuccelli Heringer Lisboa - USP, Brazil
42. Artur Oscar Lopes - UFRGS, Brazil
43. João Vitor Teixeira Maia - USP, Brazil
44. Domingos Marchetti - Universidade de São Paulo, Brazil
45. Brian Marcus - University of British Columbia, Canada
46. Marco Merkli - Memorial University of Newfoundland, Canada
47. Cesar R. de Oliveira - UFSCAR, Brazil
48. Fernando Martins Costa Olivera - UFABC, Brazil
49. Gustavo Barbagallo de Oliveira - UFMG, Brazil
50. Krerley Oliveira - UFAL, Brazil
51. Luiz Paulo Oliveira - USP, Brazil
52. Walter de Siqueira Pedra - USP, Brazil
53. Marzia Petrucci - USP, Brazil
54. Mark Piraino - University of Victoria, Canada
55. Thiago Costa Raszeja - USP, Brazil
56. Rayner Michel Ribeiro - USP, Brazil

57. Juan Rivera-Letelier - University of Rochester, USA
58. Renan Gambale Romano - UFSC-Blumenau, Brazil
59. André Galdino dos Santos - USP, Brazil
60. Tiago da Costa Santos - USP, Brazil
61. João Victor Ribeiro da Silva - Unesp, Brazil
62. Ricardo Correa da Silva - USP, Brazil
63. Edgardo Stockmeyer - Pontificia Universidad Católica de Chile, Chile
64. Izabella Stuhl - Pennsylvania State University, USA
65. Alisson Cordeiro Alves Tezzin - USP, Brazil
66. Phillippe Thieullen - Université of Bordeaux, France
67. Paulo Varandas - UFBA, Brazil