7 Sistemas Dinámicos

1. **Expositor: Adrián Esparza-Amador**[1]
Instituto de Ciencias Físicas y Matemáticas
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Valdivia, Chile

Título: p-adic transcendental dynamics.

Resumen: In recent years, the study of non-Arquimidean rational dynamics has been extended to transcendental functions in a general context. This is largely due to the fact that in the non-Archimidean world there are no explicit models of transcendental functions as there are in the Archimidean case, being the exponential function the base model.

In this talk, we will expose the most relevant results in p-adic transcendental dynamics that mark a distinction between both dynamics. Special emphasis will be placed on the classification of wandering Fatou components.

Joint work with:
Kiwi, Jan[2], Facultad de Matemáticas, Pontificia Universidad Católica de Chile, Santiago, Chile.

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2. **Expositor: Claudio Vidal**[1]
Department of Mathematics
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Concepción, Chile.

Título: Periodic solutions of time dependent perturbed Hamiltonian systems.

Resumen: The aim of this talk is to show the existence of periodic solutions of a class of time dependent 2π-periodic perturbed Hamiltonian systems of the form

$$H(t,\theta,\phi,\mathbf{p},I,J,\mathbf{q},\epsilon) = H_0(I,J) + \epsilon H_1(t,\theta,\phi,\mathbf{p},I,J,\mathbf{q}),$$

where $\theta,\phi \in \mathbb{T}$, $I,J \in \mathbb{R}$, $\mathbf{p},\mathbf{q} \in \mathbb{R}^n$.

Joint work with **Angelo Alberti**, Department of Mathematics, Universidade Federal de Sergipe, Artacaju, Brazil.

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3. **Expositor: Claudio Sierpe**[1]
Department of mathematics
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Concepción, Chile.

Título: Nolinear stability of equilibrium solutions to the spatial satellite problem when there are multiple resonances.

Resumen: Nonlinear stability in the Lyapunov sense of one equilibrium solution in an autonomous Hamiltonian systems with n-degrees of freedom, assuming the existence of two vectors of resonance, both of order four, with interaction. We provide conditions to obtain a type of formal stability, called Lie stability. Subsequently we guarantee some sufficient conditions to obtain exponential stability in the sense of Nekhoroshev for Lie stable systems. Also, we give sufficient conditions for instability in the sense of Lyapunov. We apply some of our results to the spatial satellite problem. Joint work with:
Claudio Vidal.[2], Department of mathematics, Universidad del Bío-Bío, Concepción, Chile.

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4. **Expositor: Jorge L. Zapata H.**[1]
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Concepción, Chile.

Título: The role of genetic instability in cancer evolution through the modified quasispecies model.

Resumen: We employ a modified quasispecies model to analyze an unstable tumor progression evolution. In sharp contrast with the classical quasispecies model, the modified one allows for variable growth rates for each population expanding its validity over time. Our study considers three subpopulations exhibiting an increasing number of mutations. The first shows anomalous growth, the second is genetically unstable, and the third derives from the second and clusters highly heterogeneous mutant sequences. We will conclude that a high genetic instability introduces harmful effects counteracting the initial benefits of the heterogeneous third subpopulation. We found that the evolution of all states in the biological region is determined by an attractor equilibrium, whose coordinates depend on three parameters: two competitive advantage parameters and the genetic instability parameter associated with the third subpopulation. We describe their role in detail and the mechanism of the semi-hyperbolic bifurcation they trigger.

Joint work with:
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5. **Expositor: Pablo Muñoz**
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Título: Análisis de bifurcaciones en un modelo dinámico de redes neuronales excitatorias–inhibitorias bajo sinápsis electroquímica.

Resumen: Uno de los principales objetivos de la neurociencia es comprender cómo la función cerebral surge de la dinámica colectiva de las redes neuronales interconectadas [1]. Se han formulado teorías para comprender las dinámicas sincrónicas (periódicas) y asincrónicas (incoherentes) de estados macroscópicos de las grandes redes neuronales involucradas en términos de la actividad colectiva de las neuronas mediante las tasas de disparo de estas redes diferenciando entre ellas la sinapsis química y eléctrica, mas su efecto combinado sigue siendo menos comprendido. Se presenta un avance en el modelo existente [2], donde se describió la dinámica de una red formada por neuronas excitatorias e inhibitorias como un sistema de 4 dimensiones sujeto a la incorporación de sinapsis tanto química como eléctrica en ambas poblaciones. Con el objetivo de entender la aparición de distintos regímenes dinámicos en presencia de la sinapsis eléctrica, realizamos un análisis de bifurcaciones de este modelo. El análisis del modelo entrega un escenario donde coexisten variados puntos de bifurcación de codimensión 2 para la sinapsis química (Cúspide, Hopf Generalizada, Bogdanov–Takens) añadiendo la dinámica de bi–estabilidad a estas redes. La inclusión de la sinapsis eléctrica en el modelo cambia significativamente los puntos de bifurcación anteriormente mencionados. Se identifican zonas representadas mediante diagramas de bifurcación entre los parámetros que conllevan información de la sinápsis química y eléctrica, exhibiendo nuevas dinámicas biológicamente realistas relacionadas a estados de sincronía y asincronía junto a interpretaciones biológicas sobre como evoluciona la red neuronal según la variación de sinapsis.

Trabajo realizado en conjunto con:
Patricio Orio Centro Interdisciplinario de Neurociencia de Valparaíso e Instituto de Neurociencia, Facultad de Ciencias, Universidad de Valparaíso, Valparaíso, Chile.

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6. **Expositor: Jaime Andrade**[1]
Departamento de Matemática
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Concepción, Chile.

Título: Problema restringido circular de $N+1$ cuerpos en superficies de curvatura constante.

Resumen: In this talk, we consider a restricted $(N+1)$-body problem on surfaces $\mathbb{M}^2_\kappa$, where the constant $\kappa \neq 0$ is the Gaussian curvature, which by means of a rescaling can be reduced to $\kappa = \pm 1$. This problem consists in the study of the dynamics of an infinitesimal mass particle attracted by N primaries of identical masses describing elliptic relative equilibria of the N-body problem on $\mathbb{M}^2_\kappa$, i.e., a solution where the primaries are rotating uniformly with constant angular velocity ω on a fixed parallel of $\mathbb{S}^2$ or $\mathbb{H}^2$ and placed at the vertices of a regular polygon. In a rotating frame, this problem yields a two degrees of freedom Hamiltonian system. The goal of this talk is to describe analytically some dynamics features for $\kappa = \pm 1$. Precisely, we study the relative location of equilibria, obtaining, in particular, that the poles of $\mathbb{S}^2$ and vertex of $\mathbb{H}^2$ represent equilibrium points for any value of the parameters. Thus, analysis of the nonlinear stability of these equilibria is carried out, as well as two types of bifurcations are detected: Hamiltonian-Hopf and N-bifurcation. Additionally, we prove the existence of a family of Hill's orbits and a family of periodic orbits when the primaries are located near the poles of $\mathbb{S}^2$ or the vertex of $\mathbb{H}^2$. Finally we prove the existence of KAM 2-tori related to these periodic orbits.

Trabajo realizado junto a:
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7. **Expositor: Kendry Vivas Ferrer**[1]
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Valparaíso, Chile.

Título: Chaotic behavior of ASH attractors.

Resumen: The asymptotic sectional-hyperbolicity is a weak notion of hyperbolicity that extends properly the sectional-hyperbolicity and includes the Rovella attractor as an archetypal example. The main feature of this definition is the existence of arbitrarily large hyperbolic times for points outside the stable manifolds of the singularities. In this talk we will show that any attractor associated to a C^1 vector field X on a three-dimensional manifold satisfying this kind of hyperbolicity is rescaling expansive. Besides, we will present some open problems associated with this result.

Joint work with:
E. Rego[2], Department of Mathematics, Southern University of Science and Technology, Guangdong Shenzhen, China.

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8. **Expositor: Yuki Yayama**[1]
Departamento de Ciencias Básicas
Universidad del Bío-Bío, Chillán, Chile.

Título: On generalized compensation functions for factor maps between shift spaces on countable alphabets.

Resumen: We show the existence of generalized compensation functions for a particular type of one-block factor maps $\pi : X \to Y$ between countable subshifts X and Y. For factor maps between compact spaces, continuous compensation functions were studied by Walters [3] in relation to the theory of relative pressure. Applying the thermodynamic formalism for sequences on countable subshifts [2], we generalize some existing results on factor maps between compact spaces to non-compact spaces. For related questions, we also study the existence of a preimage measure on X of an invariant measure on Y, and their relations. (The results were published [1].)

Joint work with:
Camilo Lacalle[2], Departamento de Matemática, Universidad del Bío-Bío, Concepción, Chile.

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9. **Expositor: Leonardo Parra**[1]
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Pontificifia Universidad Católica de Valparaíso, Valparaíso, Chile.

Título: Intrinsic ergodicity for a certain class of Derived from Anosov.

Resumen: To study the existence and finiteness (in particular, uniqueness) of the maximal entropy measure (*mme*) in the context of the partialy hyperbolic diffeomorphisms is typical to start with systems arising of a continouos deformation from linear Anosov diffeomorphism into a $\mathbb{T}^d$ ($d \geq 3$). The diffeomorphisms so construted are called Derived from Anosov (*DA*). In this subclass, the works can be gruped into two sets; when the central subbundle is one-dimensional or greater than one. Also, it should be considered whether the central foliation (when it exists) is formaded either by compact center leaves o by non-compact center leaves. In this talk, I will present a certain class of partially hyperbolic Derived from Anosov diffeomorphisms on $\mathbb{T}^3$ that appear after a Hopf bifurcation with 2 dimensional indecomposable central bundle. Moreover, the *DA* is dynamical coherence with non-compact central leaves two dimensional. We will describe the geometry of the equivalence classes for typical points and show that the entropy of the *DA* is preserved and has a unique ergodic *mme*.

Joint work with:
C. Lizana[2], IME, Universidad Federal de Bahia, Salvador, Brasil.
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10. **Expositor: Nicolás Arévalo H.**[1]
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Título: El espectro de Lyapunov como el método de Newton-Raphson para mapas de Markov sobre contables intervalos.

Resumen: A finales de los 90's Howard Weiss y Yakov Pesin presentaron una serie de resultados en donde relacionaban el estudio del formalismo termodinámico con el análisis multifractal de una sistema dinámico, esto es, una descomposición del espacio del sistema en conjuntos de nivel de cantidades de interés tales como la entropía, la dimensión puntual y exponentes de Lyapunov. La forma en la que estudiaron esta descomposición fue a través de las dimensiones de Hausdorff de dichos conjuntos. Para el exponente de Lyapunov la función que codifica la dimensión de Hausdorff de sus conjuntos de nivel se conoce por Espectro de Lyapunov.

En esta charla definiremos una clase funciones real-valuadas definidas sobre contables intervalos con posiblemente puntos fijos parabólicos, los mapas Markov-Renyi-Lüroth (MRL). Mostraremos que para T un mapa MRL, el espectro de Lyapunov se puede expresar en términos de la transformada de Legendre de la presión topológica de $-t\log|T'|$, generalizando previos resultados en el área. Además, mostraremos que el espectro de Lyapunov coincide con una función directamente relacionada con el método de Newton-Raphson aplicada a la presión topológica de $-t\log|T'|$.

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11. **Expositor: Dante Carrasco-Olivera**[1]
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Título: Dynamical Systems on Uniform Spaces.

Resumen: Many dynamic aspects have been and continue to be developed on the classical metric spaces ([2], [4]). Here we will focus on some dynamic properties on uniform spaces such as: expansiveness, shadowing, topological stability, etc., with a topological and measurable approaches. [1], [3].

Joint work with:
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