



Comisión Nacional de Investigación  
Científica y Tecnológica - CONICYT

## **RESEARCH TEAM GRANTS IN SCIENCE AND TECHNOLOGY**

### **FINAL REPORT**

#### **INSTRUCTIONS**

1. The following report must be thoroughly filled up indicating the general and specific results of the Research Team Grant.
2. Reviewers' suggestions on the previous report must be referred to.
3. The signatures of Main Researchers currently abroad may be included digitalized in another page.
4. Include all appendices you consider necessary to show the outcomes of the project which must be sent to the Program in a digital version only.

Concerning publications remember to include in the digital appendices the letters or email messages confirming reception or acceptance, as well as the corresponding digital copies. Only published works that declare acknowledgements to this project will be considered as resulting products from this grant.

Concerning theses (undergraduate, master's and/or PhD's) resulting from the project, remember to include in the digital appendixes the cover pages and executive summaries of each one of them.

Concerning courses, seminars, conferences, workshops where members of the project took part presenting results, dissemination events or others organized by project members, remember to include in the digital appendixes the copies of the corresponding programs, if available.

5. Once completed, the current report must be sent in printed and digital version to the following address:

***Programa de Investigación Asociativa – CONICYT  
Moneda 1375 – Santiago***

For further information and/or inquiries please contact: Karol Campos Gavilán – **[kcampos@conicyt.cl](mailto:kcampos@conicyt.cl)**.

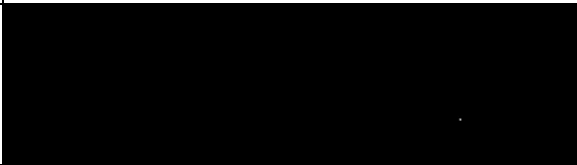


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## RESEARCH TEAM GRANTS IN SCIENCE AND TECHNOLOGY

### FINAL REPORT

#### I. PROJECT PRESENTATION

<b>PROJECT TITLE</b>		<b>CODE</b>
<b>Center for Dynamical Systems and Related Topics</b>		<b>ACT 1103</b>
<b>PROJECT DIRECTOR</b>	<b>SIGNATURE</b>	
<b>Andrés Ignacio Navas Flores</b>		
<b>MAIN INSTITUTION</b>		
<b>Universidad de Santiago de Chile</b>		
<b>ASSOCIATED INSTITUTIONS</b>		
<b>Pontificia Universidad Católica de Chile Pontificia Universidad Católica de Valparaíso Universidad de Chile</b>		
<b>PERIOD INFORMED</b>		
<b>November 2012-March 2016</b>		



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## II. RESUMEN EJECUTIVO

Esta sección no deberá extenderse más allá de 2 páginas. Resuma los logros del proyecto considerando los objetivos específicos del Instrumento, tales como:

- La realización de investigación científica y tecnológica de alto nivel y alcance internacional.
- El entrenamiento de investigadores recientemente formados y la formación de estudiantes de pre y postgrado ya sea a través de la participación activa del equipo de investigadores del proyecto en programas de postgrado ya consolidados o en su formación, tutorías a estudiantes de todas las categorías, cursos específicos en carreras o programas de pre y postgrado, etc.
- El establecimiento de redes internacionales de cooperación con otros equipos de investigación similares, Centros de investigación extranjeros, agencias internacionales, programas de estudios de instituciones extranjeras, etc.
- Desarrollo de actividades de comunicación destinadas a sensibilizar a la sociedad chilena, al sector público y privado y a sectores productivos entre otros, sobre la importancia del quehacer de la Ciencia y la tecnología y su inserción en todo aspecto de la vida cotidiana de la sociedad chilena.

Dado que este resumen debe ser asequible a aquellas personas que no son necesariamente expertas en el área, le solicitamos el uso de un lenguaje relativamente simple o explicaciones cuando términos técnicos así lo requieran.

Durante los tres años de ejecución, el proyecto DySyRF (Centro de Sistemas Dinámicos y Temas Relacionados) ha ejecutado prácticamente todas las actividades que estaban presupuestadas e incorporado nuevas, tanto en el aspecto científico como organizacional. El cambio más importante – debidamente fundamentado– es la no realización del Congreso Final, dada la amplitud y esfuerzo que había significado el encuentro precedente, Beyond Uniform Hyperbolicity, para el cual se habían obtenido fondos concursables extra. En su remplazo, se realizó un encuentro de tipo divulgativo, el Segundo Campamento de Matemáticas (CAMAT II), en sincronía con la Sociedad de Matemática de Chile (presidida por el director del Anillo, Andrés Navas): ver <http://www.elmostrador.cl/cultura/2016/03/24/campamento-de-matematicas-una-opcion-para-revertir-el-desastre-de-la-disciplina-a-nivel-escolar/>

El fruto más visible del proyecto es la producción de 37 publicaciones (además de 7 artículos aceptados y 16 sometidos) en revistas de primera línea no sólo en el área de los sistemas dinámicos sino que de la matemática en general (Inventiones Math., Ann. Institut H. Poincaré, Comm. Math. Physics, Comp. Math., Erg. Theory and Dyn. Systems, Groups geometry and dynamics, Journal d'Analyse Math., Math. Annalen, etc).

Hemos organizado y llevado a cabo cinco escuelas y siete conferencias temáticas. Además colaboramos con la organización de la Sesión Especial "Dynamical Systems (including integrable systems) en el XVIII International Congress on Mathematical Physics", July 27<sup>th</sup> - August 1<sup>st</sup>, 2015. Santiago –



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Chile. <http://www.icmp2015.cl/>

Los eventos que se han realizado a la fecha han congregado a más de 150 especialistas internacionales de primer nivel, que incluso nos han visitado en más de una oportunidad, así como 33 nacionales y cerca de 191 estudiantes nacionales y 97 extranjeros. Los miembros del Anillo han realizado 114 charlas y cursos en 54 conferencias internacionales y 18 encuentros nacionales. Esto incluye pasantías de miembros no permanentes como post-docs y estudiantes tesistas. En conjunto, se han dictado 61 charlas en encuentros y seminarios internacionales y 53 charlas en seminarios nacionales. Algunas de éstas han tenido lugar en las instituciones del extranjero que soportan el proyecto (Hebrew U., U. Chicago, U. Bourgogne, IMPA, Universidd de la República, PUC - Rio), y en otras tan importantes como el Collège de France.

El DySyRF ha mantenido un trabajo constante en la formación de nuevos científicos. Junto con apoyar y promover la inserción de nuevos investigadores (6 post-docs), se ha dirigido la conclusión de los trabajos de 3 estudiante de pregrado, 7 de magíster y 3 de doctorado. Aníbal Velozo realizó un Ph.D. en la Universidad de Princeton y Sebastián Barbieri (Master) obtuvo también una pasantía en Univ. Lyon 1/ENS Lyon, auspiciado por la cooperación francesa (programa de intercambio MYLYON, coordinado por A. Navas).

El trabajo de formación ha sido posible gracias a que se han dictado 6 mini-cursos más especializados fuera de los encuentros masivos previamente descritos. En la actualidad se encuentran en ejecución 2 de magíster y 5 de doctorado.

El DySyRF ha apoyado la realización de varias actividades masivas de divulgación de la Matemática en la sociedad tanto chilena como de habla hispana. En particular en 2014 se apoyó la impresión de la edición N°1. Año 8 junto con la diagramación y trabajo editorial. También se realizó la actividad de divulgación de alta participación ciudadana en la ciudad de Valparaíso, co-organizando y financiando el concurso "Piensa en Matemáticas 2014". Además, el DySyRF, en colaboración con el CNRS de Francia, realizó la traducción masiva de artículos del sitio web "Images des Mathématiques <http://images.math.cnrs.fr>". Un profesional especialista en divulgación científica tradujo al español de más de 200 artículos de este sitio, lo que permitió, la consolidación de una versión en español de este exitoso sitio web de divulgación de la matemática.

Miembros del DySyRF han continuado apoyando la realización de la Olimpiada Nacional de Matemáticas, dirigiendo el equipo académico de la competencia en la que participan más de 3000 estudiantes de más de 350 colegios (datos 2014). Finalmente, la actividad de cierre (el CAMAT II) congregó a cerca de 120 personas, tanto estudiantes de liceo como de primeros años de universidad, además de profesores de matemática.

La mayoría de estas actividades puede verse en la página web [www.dysyrf.cl](http://www.dysyrf.cl).



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### III. EXECUTIVE SUMMARY

This section should have no more than two pages. Summarize the project's achievements considering the specific objectives of this grant, such as:

- To conduct high-level scientific and technological research with an international scope.
- To train recently graduated researchers as well as undergraduate and postgraduate students through their active participation in the project's research team in postgraduate programs already consolidated or under creation, tutoring students in all categories, specific courses in degrees or under- or post- graduate programs, etc.
- To establish international cooperation networks with similar research teams, foreign research centers, international agencies, study programs in foreign institutions, etc.
- To develop communication activities aimed at raising awareness within Chilean society, the public and private sectors, and productive sectors, among others, regarding the importance of the work on Science and Technology and its inclusion in all aspects of Chilean society's daily life.

As this summary should be affordable to non-experts in the area, please use relatively simple language or explanations for technical terms.

During its three years of execution, the project DySyRF (Center of Dynamical Systems and Related Fields) successfully carried out almost all the activities that were budgeted- and also added new activities- in both scientific and organizational aspects. The most important change was the dissemination activity "II Campamento de Matemáticas" instead of the closing conference in view of that the previous meeting "Beyond Uniform Hyperbolicity" involved a lot of participants, strong organization and a quite wide scientific cover.

The most visible result is the production of 37 publications (other 7 accepted and 16 submitted) in leading journals not only in the area of dynamical systems but in mathematics in general (from those published / subject we highlight *Inventiones Math.*, *Ann. Institut H. Poincaré*, *Comm. in Math. Physics*, *Comp. Math.*, *Erg. Theory and Dyn. Systems*, *Groups geometry and dynamics*, *Journal d'Analyse Math.*, and *Math. Annalen*).

We have organized five Schools and seven thematic Conferences. Besides, we collaborated with the organization of the Special Session "Dynamical Systems (including integrable systems) of the XVIII International Congress on Mathematical Physics", July 27<sup>th</sup> - August 1<sup>st</sup>, 2015. Santiago - Chile. <http://www.icmp2015.cl/>

The events already performed gathered more than 150 top international



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experts, 33 national experts and over 191 national and 97 international students. Members of the DySyRF have given over 110 talks and courses in 54 international conferences and 18 national meetings. This includes non-permanent members internships, post -docs and thesis students.

Altogether, we have dictated 61 talks and courses in international meetings and seminars, and 53 in national seminars. Some of these have taken place in foreign institutions supporting the project (Hebrew U., U. Chicago, U. Bourgogne, IMPA, University of the Republic, PUC – Rio), as well as other very important ones, as for example Collège de France.

The DySyRF is constantly working in the training of new scientists. Along with support and promote the inclusion of new researchers (six post -docs), it has directed the completion of the work of 3 undergraduate student, 7 Masters and 3 PhD. One of these master students (Aníbal Velozo) has been recently attended the prestigious Ph.D. program at Princeton University. Another Master's student (Sebastián Barbieri) had an internship at the Univ. Lyon 1/ENS Lyon sponsored by the French cooperation (internship program MYLYON, coordinated by A. Navas). The training work has been possible thanks to the six courses in Dynamical Systems, besides the previously described mass meetings. Nowadays, 2 Master and 5 PhD thesis are being conducted.

The DySyRF has supported several massive mathematic activities in both Chilean and Spanish speaking society. It has continued to support the edition of the "Revista del Profesor de Matemáticas". In particular in 2014 it supported the Year 8, N.1 edition, along with the layout and editorial work. The website [www.rpmat.cl](http://www.rpmat.cl) is funded by DySyRF and managed by one of its members. Also he outreach activity "Piensa en Matemática" competition. In addition to that, the DySyRF began implementing one of its main activities of mass dissemination. This is the collaboration with the CNRS of France in the massive translation of articles on the website "Images des Mathématiques" <http://images.math.cnrs.fr>. Incorporating a professional specialist in science (Julio de Villegas) who has accomplished the spanish translation of over 200 articles on this site, which allowed, throughout 2015, the consolidation of a Spanish version of this successful website of mathematics. DySyRF members have continued to support the realization of the National Mathematics Olympiad, directing the academic team competition in which more than 3000 students from over 350 schools (2014 data) are involved. Finally, the closing activity II CAMAT involved almost 120 people, most of them school students and teachers, with a very high impact; see <http://www.elmostrador.cl/cultura/2016/03/24/campamento-de-matematicas-una-opcion-para-revertir-el-desastre-de-la-disciplina-a-nivel-escolar/>

Most of the activities are displayed on the web page [www.dysyrf.cl](http://www.dysyrf.cl)

## ACTIVITIES

This section should have five pages as maximum. Indicate the activities performed considering those commitments stated by the team researchers in the Original Proposal and stated in the last Annual Activities Plan. Each activity should have a headline and 2-3 explanatory lines including if they have been performed and if not indicating why.

Please consider **the specific objectives of this grant.**

### A. Conferences:

During its execution, the DySyRF Project organized seven conferences and collaborated with ICMP. Each of these gathered the best world-specialists in the subjects as well as many graduate students.

1. *"Nonpositive Curvature, Isometric Actions, and Dynamics of Cocycles"* May 6th -11th, 2013. Cajón del Maipo - Chile. Performed. <http://www.sistemasdinamicos.cl/conferences/nonpositive13>
2. *"Thermodynamical Formalism and Applications"* July 8th -13th, 201. PUC - Chile. Performed. <http://www.sistemasdinamicos.cl/conferences/termo2013/>
3. *"Groups and Dynamics II"* April 21<sup>st</sup>, 2014. USACH, Santiago- Chile. Performed. <http://www.sistemasdinamicos.cl/conferences/GDII/>
4. *"Orderable Groups"* September 1<sup>st</sup>-6<sup>th</sup>, 2014. Cajón del Maipo- Chile. Performed. <http://www.sistemasdinamicos.cl/conferences/OrderableGroups/>
5. *"Workshop on Symbolic Dynamics on finitely presented Groups"*, December 15<sup>th</sup>-19<sup>th</sup> Santiago, Chile. Performed. <http://www.dim.uchile.cl/~mschraudner/SyDyGr/>
6. *"Global Dynamics Beyond Uniform Hyperbolicity"* August 31<sup>st</sup> - September 11<sup>th</sup>, 2015. Olmué - Chile. Performed. <http://ima.ucv.cl/beyond/>
7. *"Valparaiso's dynamics working days: Groups and low dimensional dynamics"*, October 15<sup>th</sup> - 16<sup>th</sup>, 2015. PUCV, Valparaíso, Chile. <http://ima.ucv.cl/congreso/valparaiso-dynamics/>

Collaboration with the Special Session *"Dynamical Systems (including integrable systems) of the XVIII International Congress on Mathematical Physics"*, July 27<sup>th</sup> - August 1<sup>st</sup>, 2015. Santiago - Chile. Performed. <http://www.icmp2015.cl/>

### B. Schools:

The DySyRF also organized 5 schools with 44 international / 39 national researchers and 47 international/ 81 national students, from all over Latin America.

1. *"VIII Escuela Internacional de Sistemas Dinámicos"* July 15<sup>th</sup> -19<sup>th</sup>, 2013.



San Pedro de Atacama - Chile.

<http://www.sistemasdinamicos.cl/conferences/escuela2013/>

2. "CIMPA Research School on Geometric Methods in Classical Dynamical Systems" Performed. September 25<sup>th</sup>- October 3<sup>rd</sup>, 2014. USACH, Santiago- Chile. <http://members.unine.ch/felix.schlenk/Santiago/>
3. "School on Orbit Equivalence and Related Fields" Performed. December 1<sup>st</sup>-5<sup>th</sup>, 2014. USACH – Chile. <http://www.sistemasdinamicos.cl/conferences/orbitequivalence2014/>
4. "Chile-New Zealand Workshop on Dynamical Systems", January 6<sup>th</sup>-8<sup>th</sup> 2015. PUCV-Chile. <http://ima.ucv.cl/congreso/cl-nz-dynamics/>
5. "Campamento de Talentos Matemáticos CAMAT 2016" March 14<sup>th</sup> – 18<sup>th</sup>, 2016. CPEIP, Santiago, Chile <http://somachi.cl/camat2016/>

### C. Santiago's joint Seminar SCS-D:

The DySyRF strongly supported the Santiago's Dynamical Systems Seminar (<http://www.dysyrf.cl/seminar/santiagos-joint-seminar/>) both logistically and financially, accomplishing 103 sessions. Most of the speakers were funded by the DySyRF.

The complete list of Speakers and talks is available in **Appendix B1**.

### D. Valparaíso's Seminar Dinámica Porteña:

The DySyRF also funded the Valparaíso's Dynamical Systems Seminar (<http://ima.ucv.cl/seminarios/dinamica-portena/>), accomplishing 81 sessions. The complete list of Speakers and talks is available in **Appendix B2**.

### E. Courses:

Besides the International Schools, researchers from the Center are regularly organizing courses to get up-to-speed on the latests developments in the field to attract new students to the field and also to train postgraduate students.

<http://www.dysyrf.cl/courses/>

1. "Symbolic Dynamics". Michael Schraudner, CMM, U.de Chile (II Semester 2013).
2. "Ergodic Theory, Entropy and Coding". Michael Schraudner, CMM, U.de Chile (II Semester 2013).
3. "Introducción a los Sistemas Dinámicos y Teoría Ergódica". Alejandro Mass, U. de Chile (II Semester 2013).
4. "Introducción a los Sistemas Dinámicos". Mario Ponce, PUC (II Semester 2013).
5. "Geometría y análisis de grupos y estructuras discretas". Andrés Navas, USACH. (Master and PhD, II semester 2013).

6. "*Introducción a la Teoría Ergódica*". María Isabel Cortez, USACH (Masters and PhD Degree, II semester 2013).
7. "*Propiedades estadísticas de los sistemas dinámicos*". José F. Alves, Universidade de Porto, Portugal  
March 24<sup>th</sup> – 29<sup>th</sup>, Universidad Austral de Chile, Valdivia.  
April 21<sup>st</sup> – 25<sup>th</sup>, Universidad Católica del Norte, Antofagasta.  
May 12<sup>th</sup> - 17<sup>th</sup>, Pontificia Universidad Católica de Valparaíso, Valparaíso.  
Joint with Nelda Jaque, UCN, Chile (Part III: Medidas SRB y difeomorfismos parcialmente hiperbólicos)
8. "*An Introduction to the Ising Model*" Rodrigo Bissacot. Universidad de Sao Paulo, Brazil. Apr. 23<sup>th</sup>-25<sup>th</sup>, 2014. Universidad Andrés Bello.
9. "*Probabilistic features of expanding dynamical systems with spectral techniques*" Sandro Vaienti, Centre de Physique Théorique, Université de Marseille, France.  
May 19<sup>th</sup> – 22<sup>nd</sup>, 2014. PUCV.  
June 10<sup>th</sup> & 12<sup>th</sup>, 2014. PUCV. ( Part II)
10. "*Introducción a la Teoría de Ratner*". Pablo Carrasco, Univ. de Sao Paulo. Brazil.  
Aug. 12<sup>th</sup> & 14<sup>th</sup>, 2014. USACH
11. "*Difeomorfismos Axioma A*". Nelda Jaque, Universidad Católica del Norte.  
Oct. 29<sup>th</sup>- Dec. 17<sup>th</sup>, 2015. PUCV.
12. "*Operador de Transferencia y sus aplicaciones*". Fabián Contreras, PUCV.  
Oct. 29, 2015. (8 sessions course) PUCV.

#### **F. Visitors:**

The Center strongly supported international collaboration. The complete list of international speakers participating in Santiago's joint Seminar & Dinámica Porteña goes up 78 researchers, many of them visiting us in more than one opportunity and is available in **Appendix B3**.

Besides them, the Center welcomed xx researchers from all over the world in its Conferences, the complete list is available in **Appendix B4**.

#### **G. Students:**

One of the main goals of this Center is encouraging young people to follow the research path. That is the reason why, during these three years, the following students have been funded by the DySyRF. For details see **Appendix B5**.

Seven Postdocs:

1. Mickaël Crampon, USACH. Under the supervision of Andrés Navas.
2. Matthieu Calvez, USACH, Fondecyt. Under the supervision of Andrés Navas.

3. Mahdi Teymuri Garakani, USACH, Dicyt. Under the supervision of Andrés Navas.
4. Jean Baptiste Aujogue, USACH, Fondecyt. Under the supervision of M. I. Cortez.
5. Ville Salo, U. de Chile. Under the supervision of Michael Schraudner.
6. Maryam Hosseini, USACH. Under the supervision of María Isabel Cortez.
7. Mahsa Allahbakhshi, USACH, Dycyt. Under the supervision of Andrés Navas.

Eight PhD Students:

1. Gonzalo Castro, Under the supervision of Andrés Navas. PhD thesis: *"Probabilistic and analytical aspects of nilpotent group actions on the interval"*. Finished Jul 2013. USACH.
2. Alexander Frank, Under the supervision of Alejandro Maass. PhD thesis. *"Contribución al estudio de valores propios en sistemas de Bratteli-Vershik de rango finito"*. Finished, May 2014. DIM, Universidad de Chile.
3. Sebastián Donoso, Under the supervision of Alejandro Maass. PhD thesis: *"Dinámica Simbólica de Nilsistemas"*. Finished on May 2015. DIM, Universidad de Chile.
4. Rodolfo Viera, Under the supervision of Andrés Navas. PhD thesis. *"Geometría de estructuras discretas"* In Progress. USACH
5. Nelda Jaque, Under the supervision of Bernardo San Martín. PhD thesis. *"Atractores para semi flujos impulsivos"* In progress. UCN.
6. Juan Carmona, Under the supervision of Bernardo San Martín. PhD thesis. *"Campos Polinomiales de bajo grado que presentan atractores con singularidades centralmente contractoras"* In progress. UCN.
7. Enzo Fuentes, Under the supervision of Radu Saguin (2014) PhD Thesis. *"Continuidad absoluta de foliaciones invariantes para difeomorfismos de Anosov  $C^1$  genéricos"*. In Progress. PUCV.
8. Ignacio Monteverde, Under the supervisión of Nancy Guelman and Andrés Navas In Progress. U. República, Uruguay.

Nine Master's students:

1. Enzo Fuentes, Under the supervision of Radu Saguin (2013) Master's degree. *"Medidas invariantes y operadores de transferencia para algunos sistemas dinámicos"* Finished 2013. PUCV.
2. Aníbal Velozo, Under the supervision of Godofredo Iommi (2014). Master's degree. *"Dinámica en billares hiperbólicos"* Finished 2013. PUC-Chile
3. Sebastian Barbieri, Under the supervision of Michael Schraudner. Master's degree on Mathematics. *"Subshifts Generados por Sustituciones Multidimensionales"*. Finished on July 2014. DIM Universidad de Chile.

4. Bastián Galasso, Under the supervision of Godofredo Iommi. Master's degree. "Velocidades de Aproximación de un número real por sucesiones de la forma  $\{N^{\alpha}\}$ ". Finished 2014. PUC-Chile.
5. Hugo Maturana, Under the supervision of María Isabel Cortez. Master's degree. " *Sistemas de Toeplitz. Propiedades dinámicas, odómetro y grupo de dimensión.*" Finished on April 2015. USACH
6. Felipe Fresno, Under the supervision of María Isabel Cortez. Master's degree. " *Valores propios asociados a un sistema de Cantor minimal*". Finished on 2015. USACH
7. Igraine Quiroz, Under the supervision of María Isabel Cortez and Cristóbal Rivas. Master's degree. " *Grupo pleno topológico asociado a un Sistema de Cantor minimal*". Finished on 2015 USACH.
8. José Luis Pérez, Under the supervision of Andrés Navas. Master's degree. " *Embaldosados del plano hiperbólico*". In Progress. USACH
9. Fernanda Torres, Under the supervision of Mario Ponce. Master's Degree. " *Derivada proyectiva y billares hiperbólicos exteriores*" In progress. PUC-Chile.

Three undergraduate students:

1. Aníbal Velozo, Under the supervision of Mario Ponce (2012). Undergraduate thesis. " *Medidas minimizantes para el ejemplo de Mañé en el toro*" Finished in 2012. PUC-Chile
2. Diego Nava Saucedo, Internship at CMM. Under the supervision of M. Schraudner Finished 2014
3. Jorge Olivares Viñales. Under the supervision of Bernardo San Martín, Daniel Coronel. Undergraduate thesis. " *Medidas invariantes para funciones multimodales*". Finished oct.2014 UCN-UNAB..



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## IV. OUTPUTS

In this section refer to the results of the project related to each of the specific objectives of the grant and based on the three year productivity reported in the website: [http://portaldelinvestigador.cl/en/pia\\_reportes](http://portaldelinvestigador.cl/en/pia_reportes).

Do not provide lists of outputs but refer to the total outcomes during the development of the project explaining relevant aspects of the processes behind the results.

It could be considered any of the following fields required in the Productivity System: indexed Publications, Books, awards, Organization of scientific events, Participation in Scientific Events, Collaboration, thesis, Postdoctoral Fellows, Outreach Activities, Patents.

### **Publications**

During its execution, the DySyRF has accomplished 37 published papers, 7 accepted and 16 submitted to very prestigious mathematical journals. (See detail in Appendix B6 – B10)

### **Books**

There is one book named "Groups, Orders, and Dynamics" written by the Director of the Project, in collaboration with a Chilean postdoc Cristóbal Rivas - who is part of the Center- and Bertrand Deroin, from Ecole Normale Supérieure.

### **Awards**

Navas and M. Ponce, main researchers of the DySyRF, have been awarded for their outstanding work. Andrés Navas received the Mathematical Council of the Americas Prize in the MCA Congress held in Guanajuato, México (2013), for distinguished results at the early stage of his career. Mario Ponce received - together with his coauthor, Patricio Santibáñez- the Paul Halmos-Lester Ford award by the Mathematical Association of America for his paper "On Equidistant Sets and Generalized Conics: the Old and the New" published in the American Math. Monthly.

### **Organization of Scientific Events**

The DySyRF managed to organize 7 conferences, 2 thematic schools and a major dissemination event which can also be considered as a thematic school (mostly addressed to college students).

## **Participation in Scientific Events**

The great success that the Center has in Chile, as well as abroad, has contributed to a increasing number of invitations to participate, give talks or Mini-courses, in several Institutions and Conferences. Altogether, the researchers have given 61 talks in International Institutions/ Conferences, and 53 in National ones.(See detail in **Appendix B11**)

## **Collaboration**

As mention before, the Center collaborated with all the expected institutions: IMPA, PUC-Rio, U. Chicago, U. Bourgogne, Hebrew University, etc. Besides, during the third year, extra funds were perceived for the collaboration with IMPA, U. Chicago and U. Bourgogne for the organization of the very last conference ("Dynamics Beyond Uniform Hyperbolicity"). Also see **Appendix B12**.

## **Theses**

3 PhD thesis have been finished, as well as 7 Master's Degree. and 3 undergraduate.

## **Postdoctoral Fellows**

1. Mickaël Crampon, USACH, funded by Fondecyt. Under the supervision of Andrés Navas.
2. Matthieu Calvez, USACH, funded first by Fondecyt and later by Dicyt USACH. Under the supervision of Andrés Navas.
3. Mahdi Teymuri Garakani, USACH, funded by Dicyt USACH. Under the supervision of Andrés Navas.
4. Jean Baptiste Aujogue, USACH, first funded by Dicyt USACH and later by Fondecyt. Under the supervision of M. I. Cortez.
5. Ville Salo, U. de Chile, fuded by the Anillo project. Under the supervision of Michael Schraudner
6. Maryam Hosseini, USACH, funded by the Anillo project. Under the supervision of María Isabel Cortez.
7. Mahsa Allahbakhshi, USACH, funded by Dicyt USACH Under the supervision of Andrés Navas.

## Outreach Activities

- "Revista del Profesor de Matemáticas", with up to 1.000 copies and over 500 visits per month on its website. The website [www.rpmat.cl](http://www.rpmat.cl) is funded by DySyRF and managed by one of its members.
- An outreach activity of high citizen participation was conducted in the city of Valparaiso last year, co-organizing and financing the "Piensa en Matemática" competition, proposed, through posters placed in subway cars of Merval, math problems for its users. These problems were also distributed in table mats of coffee houses. The public exposed to the activity is estimated at over 15,000 people (the activity is conducted in collaboration with EXPLORA-Vta region).
- The DySyRF also began implementing one of its main activities of mass dissemination. In collaboration with the CNRS of France, the DySyRF financed the massive translation of articles on the website "Images des Mathématiques" <http://images.math.cnrs.fr>. The specialist in science Julio de Villegas accomplished the spanish translation of over 200 articles on this site, which allowed, throughout 2015-2016, the consolidation of a Spanish version of this successful website of mathematics.
- The Director of the DySyRF has published many articles on the website of the electronic paper "El Mostrador" (<http://www.elmostrador.cl/autor/anavas/>) and the Conicyt dissemination website Redciencia (<http://www.redciencia.net/contenido/opinion/157>). In mean, each entry in El Mostrador is shared by about 800 people in social networks, which is a kind of spectacular result for dissemination scientific articles.
- DySyRF members Mario Ponce and Andrés Navas have also continued to support the realization of the National Mathematics Olympiad. Ponce directs the academic team competition in which more than 3000 students from over 350 schools (2014 data) are involved.
- Finally, the closing activity CAMAT II involved almost 120 people, most of them school students and teachers, with a very high impact; see <http://www.elmostrador.cl/cultura/2016/03/24/campamento-de-matematicas-una-opcion-para-revertir-el-desastre-de-la-disciplina-a-nivel-escolar/>



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## V. HIGHLIGHTS

In no more than three pages, indicate the main outcomes and/or activities which must be considered the most significant results of the project. Please consider the specific objectives of this grant.

There are several highlights concerning the DySYRF that we would to stress.

The first concerns the scientific production. During its execution the DySyRF has produced, 37 papers that are already published, 8 accepted to be published in a short period and 15 submitted works. As it was mentioned in the executive summary, published/accepted works are appearing in important journals, and we can still add the fact that the submissions have been made to first-order journals (e.g. Journal of Topology). Besides, 7 post-docs, 8 PhD students, 9 Master students and 3 undergraduate students have been involved in this project.

A second highlight concerns the organization of events (seven conferences and five thematic schools) as well as the periodic realization of our seminar both in Santiago and Valparaíso.

The third highlight concerns dissemination, where people from DySyRF (notably Mario Ponce and Andrés Navas) have collaborated in plenty of activities, the most important one being the closure school II CAMAT, which is planed to be pursued next year by another Anillo project in mathematics ("Geometry at the Frontier").





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## **VI. LESSONS LEARNED**

The following section can be used in case of available information related to the possible difficulties, inconveniences or similar issues in the management of the project within the host institution, between CONICYT and the host institution, institution and researchers or any other combination of participants and activities involved. Information provided in this section must be concise, stating all variables involved and outcomes. Do not extend further than two pages.

This information could be used to improve the practices in future initiatives.

At this stage, the only comment we can do in this direction is that it is quite a pity that there is possibility of renewal for the funding of an Anillo project. The DySyRF has carried out an impressive work in all aspects, yet we were unable – because of formal rules- to apply neither for a new Anillo competition nor for a Milenio one. Certainly, this will be reflected in the scientific production and the impact of the work by the DySyRF in the coming years until we may apply for a new competition.



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## **VII. COMMENTS TO PREVIOUS EVALUATIONS**

Refer to the observations and/or suggestions stated by the reviewers in the last evaluation. Explain how the research team worked on those comments and/or suggestions. Please do not extend further than two pages.

On the previous evaluation, one of the referees asked for acknowledgments to the project in all publications of the DySyRF. However, as we promptly responded, this has been the case, and the corresponding recognitions appear on the official versions of the 37 published, 7 accepted and 16 submitted papers.