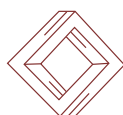


# CONTEMPORARY MATHEMATICS

657



**APORTACIONES MATEMÁTICAS**  
SOCIEDAD MATEMÁTICA MEXICANA

## Mexican Mathematicians Abroad: Recent Contributions

First Workshop  
Matemáticos Mexicanos Jóvenes en el Mundo  
August 22–24, 2012  
Centro de Investigación en Matemáticas, A.C.,  
Guanajuato, Mexico

Noé Bárcenas  
Fernando Galaz-García  
Mónica Moreno Rocha  
Editors



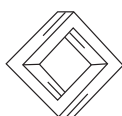
# Mexican Mathematicians Abroad: Recent Contributions



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## Prologue

As we well know, ever since the modern study of mathematics began in Mexico a little over seventy years ago, many Mexican mathematicians have studied abroad at many different universities in many different countries. Interestingly, however, to date the vast majority of us have returned to Mexico, and are occupying a variety of positions, mostly academic. Like the Mexican mathematicians currently scattered around the world, when we embarked on the adventure and enterprise of carrying out our graduate studies abroad, we wanted to stay connected with the Mexican mathematical community and with our fellow students abroad.

As a background to the “Mexican Mathematicians in the World Meeting” in Guanajuato in 2012, and to these proceedings, I have vague memories of Socorro Soberón, José Seade, Elías Micha and me in Oxford in early 1979 talking about how interesting it would be, both academically and socially, to organize a meeting of Mexican mathematicians studying in Europe at the time, in which we would talk about our doctoral work and, of course, share our experiences. With the enthusiasm of youth, we decided to organize the meeting for the coming summer and hold it at University of Cambridge. I still remember the astonished face of the famous Professor J. W. S. Cassels, Sadleirian Professor of Pure Mathematics at Cambridge, at the time head of the Department of Pure Mathematics and Mathematical Statistics, when I proposed our idea and asked for the use of their facilities for the meeting. He generously agreed, and a similar process was repeated when I requested reservations for some rooms in Pembroke College, Cambridge, to accommodate visiting participants. The meeting, which was called the “First Congress of Mexican Mathematicians Abroad” was held on June 26 to 29, 1979. There are a number of differences between the original conference and the 2012 meeting that are no doubt a reflection of the change for the better that Mexican mathematics has undergone. At the original Cambridge meeting, we were few in number, the most advanced of us were in our third year of graduate studies, and communication among us was limited to a few short letters and a very small number of telephone calls between those who were at Oxford (Soberón, Seade and Micha) and me, at Cambridge. The congress had only twelve presentations, on topics in analysis, geometry, and topology. Besides those already mentioned, the participants were Amira Acosta (Leipzig), Marcelo Aguilar (Warwick), Ricardo Berlanga (Cambridge), Berta Gamboa (Paris VI), Carlos Gómez Mont (Harvard), José Alfredo Jiménez (Durham), Guillermo Pastor (Warwick) and Guillermo Sienra (Southampton). I also remember that in addition to the scheduled talks, there was a presentation by Spanish mathematician Lucía Contreras, then a student of José María Montesinos, who was visiting Cambridge at the time. I am able to list these facts thanks to José Seade



who took the time to collect some of the proceedings, of which there are still a few copies extant today, although I must confess that when I look at them, sometimes I can hardly believe that it actually happened. I should also note that in 1980 the Mexican students in Warwick, who now also included Ricardo Berlanga, held a second such conference, but I have little documented information about it. A notable point about our first congress is that at least ten of the twelve presenters did return to Mexico.

Another piece of the prior history leading up to the 2012 “Mexican Mathematicians in the World Meeting” took place earlier the same year at the 2012 Joint Meeting of the SMM–RSME at Malaga, Spain in January. Fernando Galaz García approached Luis Montejano, who was president-elect of the SMM at the time, about the plans that he, Noé Bárcenas and Mónica Moreno were making for the meeting that gave rise to these proceedings. Upon learning about these plans, Montejano offered them all the support that the SMM could give. After the Málaga conference, during a visit to the Alhambra, Montejano told me about the enormous momentum he observed in the new generations of Mexican mathematicians. More than thirty years on, I noted, much and little have changed at the same time. Since the first meeting, the Mexican mathematical community has grown in number and in diversity of areas, and there are representatives of the young generations in many more universities and countries. Moreover, our research is rather more internationally visible. In my opinion, the new generations are also more aware that their talent and training makes them competitive in the profession anywhere in the world. I also say little, because of the enormous challenge we have in our country to palpably affect their development, progress in this direction has been slight, and continues to be something which we all owe to our country.

I feel honored that the editorial committee of *Aportaciones* has asked me to write a brief prologue to these conference proceedings. The objectives proposed for the meeting have much to tell us; the conference aims to bring Mexican mathematicians abroad together with mathematicians in Mexico, to disseminate the work of young Mexican mathematicians abroad, to enable graduate students abroad to share and exchange experiences, to analyze opportunities for returning to Mexico, and to build and strengthen global networks. Another notable feature is that these proceedings include not only reports of work in analysis, geometry and topology as in the old days but also topics in algebra, applied mathematics and probability. I am confident that the current generation of young Mexican mathematicians, particularly those who are now outside the country, will lead Mexican mathematics to new frontiers. It is commendable that in addition to the hard work they do to advance in their profession, they make the effort to stay in touch with each other and above all not to lose their ties and commitment to our nation. These proceedings present just a sample of what they can achieve, and my desire for them is that their enthusiasm and optimism may long endure.

José Carlos Gómez Larrañaga  
Centro de Investigación en Matemáticas, A. C. and  
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## Preface

The present volume contains a sample of research work by young Mexican mathematicians currently working abroad, on the occasion of the workshop “Matemáticos Mexicanos Jóvenes en el Mundo”, which took place at CIMAT, in Guanajuato, Mexico, on August 22–24, 2012. The workshop had three main goals: fostering the collaboration and exchange of ideas among young Mexican mathematicians working abroad and their peers in Mexico; exchanging experiences concerning studying and working overseas; and designing strategies to strengthen links between mathematical research institutions in Mexico and Mexican mathematicians around the world.

The history of professional mathematics in Mexico is relatively recent and spans less than 75 years. The Instituto de Matemáticas of the Universidad Nacional Autónoma de México (UNAM) was created in 1942 in Mexico City and became the first center fully devoted to mathematical research in the country. The following year saw the foundation of the Sociedad Matemática Mexicana (SMM) and the first issue of its research journal: the *Boletín de la Sociedad Matemática Mexicana*. Nowadays, there are at least six mathematics research centers (with several units around the country) in addition to at least 19 schools and departments of mathematics at public and private universities, according to a list maintained by the SMM.

The development of mathematics as an active research discipline in Mexico has gone through several phases. Among these, one can identify a foundational period centered at the Instituto de Matemáticas at UNAM in the 1940’s and 1950’s which extended and deepened mathematical activity originated in the Facultad de Ciencias at UNAM. This period experienced an important influence from Solomon Lefschetz and culminated with the creation of the Centro de Investigación y Estudios Avanzados (CINVESTAV) and the Escuela Superior de Física y Matemáticas at the Instituto Politécnico Nacional (IPN) in 1961.

A subsequent period of expansion was marked by the creation of the Centro de Investigaciones en Matemáticas Aplicadas, Sistemas y Servicios (CIMASS) at UNAM, in 1970, and the Universidad Autónoma Metropolitana, in 1974. CIMASS eventually evolved into the actual Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS), in 1976. In 1980 the Centro de Investigación en Matemáticas (CIMAT) was founded and became one of the first public research centers outside Mexico City. In the last twenty years, the need for decentralization and the growth in some of the already established institutions have led to the creation of associated representations and units (e.g. Cuernavaca, Juriquilla and Oaxaca,

for IMUNAM, and Aguascalientes, Mérida, Monterrey and Zacatecas, for CIMAT) and autonomous research centers (e.g. Centro de Ciencias Matemáticas at UNAM, in Morelia) all around Mexico. Parallel to these events, mathematical research has also found a place in public and private universities, such as the Instituto Tecnológico Autónomo de México, Universidad Autónoma de Yucatán, Universidad de Guanajuato, Universidad Juárez Autónoma de Tabasco, Universidad Michoacana de San Nicolás de Hidalgo, Universidad de Sonora and Universidad Veracruzana, to name a few.

The emergence of competitive undergraduate and graduate programs in mathematics around the country has been one of the consequences of the aforementioned development. These programs have been producing a steady number of mathematicians that complete their professional education with doctoral studies or post-doctoral experience abroad, integrating themselves into academic life in their host countries and extending the Mexican mathematical community internationally. The first known effort towards connecting Mexican mathematicians in foreign countries was embodied in the meeting “Primer Congreso de Matemáticos Mexicanos en el Extranjero”, held in Cambridge, Great Britain, on June 26–29, 1979. This conference had twelve speakers and brought together Mexican mathematicians living in four different countries and working in analysis, geometry and topology.

The constant growth in the number of Mexican mathematicians abroad in the last decades made a new effort at assembling our colleagues out of the country long overdue, prompting the organization of the workshop “Matemáticos Mexicanos Jóvenes en el Mundo”. The meeting gathered 56 participants from 35 universities distributed in 14 countries and it managed to attract graduate students coming from Argentina, Chile, Colombia, and Costa Rica. There was a Q&A session for graduate students interested in studying abroad, along with several informal discussion sessions. Our 17 speakers were young Mexican mathematicians (in the early postdoctoral stage or at the end of their Ph.D. studies) working at institutions in the United States, Canada, Europe, and South America. The talks were grouped into several areas: analysis and algebra, probability and applied mathematics, and geometry and topology, with each group roughly corresponding to a day of activities.

We thank CIMAT, the Sociedad Matemática Mexicana, the Centro de Ciencias Matemáticas at UNAM and the Departamento de Matemáticas of the Universidad de Guanajuato for their support in organizing this meeting. We also thank the speakers and the participants for their enthusiastic response, which helped to bring the workshop to a successful conclusion. Finally, we thank the authors, the referees, and the editorial committees and staff of *Aportaciones Matemáticas* and *Contemporary Mathematics* for their support in the preparation of these proceedings.

Noé Bárcenas  
Fernando Galaz-García  
Mónica Moreno Rocha



Collection of Socorro Soberón

Participants at the First Congress of Mexican Mathematicians Abroad, University of Cambridge, June 26–29, 1979.



Photo by CIMAT A.C.

Participants at the First Workshop Matemáticos Mexicanos Jóvenes en el Mundo, CIMAT, August 22–24, 2012.



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This volume contains the proceedings of the First Workshop “Matemáticos Mexicanos Jóvenes en el Mundo”, held from August 22–24, 2012, at Centro de Investigación en Matemáticas (CIMAT) in Guanajuato, Mexico.

One of the main goals of this meeting was to present different research directions being pursued by young Mexican mathematicians based in other countries, such as Brazil, Canada, Colombia, Estonia, Germany, Spain and the United States, showcasing research lines currently underrepresented in Mexico.

Featured are survey and research articles in six areas: algebra, analysis, applied mathematics, geometry, probability and topology. Their topics range from current developments related to well-known open problems to novel interactions between pure mathematics and computer science. Most of the articles provide a panoramic view of the fields and problems the authors work on, making the book accessible to advanced graduate students and researchers in mathematics from different fields.

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