

EL DFT: 45 AÑOS DE TEORÍA CUÁNTICA DE CAMPOS EN CUBA

THE DFT: 45 YEARS OF QUANTUM FIELD THEORY IN CUBA

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We briefly review the history and achievements of the Department of Theoretical Physics (DFT) of the ICIMAF since its foundation in 1976. The data and opinions of former and current members of the DFT were taken from a series of interviews made to the participants of the scientific conference FT-45, held virtually in March 2021, to celebrate the 45th anniversary of the DFT.

Reparamos brevemente la historia y logros del Departamento de Física Teórica (DFT) del ICIMAF desde su fundación en 1976. Los datos y opiniones de miembros previos y actuales del DFT fueron tomados de una serie de entrevistas realizadas a los participantes de la conferencia científica FT-45, realizada virtualmente en marzo de 2021, para celebrar el 45 aniversario del DFT.

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I. INTRODUCTION

Around 1970, first generations of Cuban physicists started to regularly go to high-level research centers in the former socialist countries to obtain their Ph.D.s. As part of that group, in the summer of 1974, professor Hugo Pérez Rojas arrived at the Lebedev Institute to begin his doctoral studies in finite-temperature quantum field theory under the supervision of Efim S. Fradkin and Anatoli E. Shabad. In the course of his research, which was carried out between Moscow and Havana, the vice-president of the Cuban Academy of Sciences (ACC), Dr. José Altshuler Gutwert, suggested to professor Hugo the creation of a department devoted to particle physics as a part of the ININTEF¹. Hence, in March 1976, the Group of Theoretical Physics was born. After 45 years and several changes of denomination, location, and affiliation, the group is known as the Department of Theoretical Physics (DFT after its acronym in Spanish) of ICIMAF and can be found at the intersection of E and 15th streets in Vedado, Havana.

Still working under the leadership and inspiration of professor Hugo, the DFT is currently composed by fourteen full-time researchers ranging from senior investigators to graduate students, six regular collaborators from other institutions, and several undergraduate students from the Faculty of Physics of the University of Havana. Its scientific activity revolves also around the senior researchers Dr. Alejandro Cabo Montes de Oca, Dr. Augusto González, Dr. Aurora Pérez Martínez, and Dr. Elizabeth Rodríguez Querts.

The ties with the Lebedev Institute and other Russian research centers from 1976 to 1990 were crucial to the establishment of the main research lines of the DFT and to the education of its members. Although these relations declined after the collapse

of the socialist block, new bonds have been established since then between the department and a number of prestigious international research institutions like the ICTP in Italy, the CINVESTAV in Mexico, the FIAS in Germany and the TWAS. All in all, the DFT has had scientific links with more than twenty-three research centers and universities of sixteen countries. Over time, its initial scope expanded from finite-temperature quantum field theory to other areas such as condensed matter physics, high energy physics, gravitation and astrophysics, and biophysics, to name a few.

As a result of its academic activity, the DFT accumulates more than 300 peer-reviewed scientific publications (Fig. 2), more than sixty thesis from bachelor to Ph.D., and more than twenty collective research awards given by the the Cuban Academy of Sciences (ACC), and the Cuban Agency for Nuclear Energy and Advanced Technologies (AENTA). Several of its members have received important national and international awards. Dr. Hugo Pérez Rojas (2011), Dr. Alejandro Cabo Montes de Oca (2012), and Dr. Augusto González (2014) have been awarded the National Manuel F. Gran Physics Prize given by the Cuban Physics Society to recognize their life achievements. The Order Carlos J. Finlay was granted by the Cuban government to Dr. Hugo Pérez Rojas (2011), Dr. Alejandro Cabo Montes de Oca (2005), and to Dr. Aurora Pérez Martínez (2018) to recognize their contributions to the socio-economic development of the country. Dr. Aurora Pérez Martínez and Dr. Elizabeth Rodríguez Querts have received the Sofia Kovalevskaya Award. In 2023, Dr. Hugo Pérez Rojas was granted the Spirit of Abdus Salam Award for his dedication to the development of science and technology in the developing world.

The DFT is known for the high quality of the conferences it frequently hosts. The international conferences

¹Institute of Technical and Fundamental Research, that evolved years later into the Institute of Cybernetics, Mathematics and Physics (ICIMAF)

STARS/SMFNS, organized every other year since 2003, is one of the larger physics event in the country and the only one devoted to astrophysics. The STARS/SMFNS pre-school is expected with special interest by students, while the Latin-American Conferences on High Energy Physics, Particles and Strings, are remembered as one of the best events ever attended by many of the interviewees.



Figure 1. Some members, collaborators and staff of the DFT (12/16/2017). From top to bottom and left to right: Hugo Pérez Rojas (founder), Alejandro Cabo Montes de Oca, Mónica Rojas Vidaurreta, Duvier Suárez Fontanella and Diana Alvear Terrero; Gabriel Gil Pérez, Gretel Quintero Angulo and Lismary Suárez González; Augusto González, Aurora Pérez Martínez, Yamila Chong Riera, Elizabeth Rodríguez Querts and Daryel Manreza Paret; Samantha López Pérez and José Carlos Suárez Cortina.

In parallel to research, the department maintains an active participation in physics education, promotion and divulgation. Many of its members teach undergrad and graduate physics. Hugo Pérez Rojas, Alejandro Cabo Montes de Oca, and Augusto Gozález are members of the Cuban Academy of Sciences. Augusto González has been president of the Cuban Physics Society, while Aurora Pérez Martínez and Elizabeth Rodríguez Querts have been vice-presidents. Aurora Pérez Martínez is the founder chief of the Women's section of the Cuban Physics Society.

Among the outreach activities of the DFT stand out the exhibition of intervened microscopy photos "Paisajes del micromundo"(2011), the video clip "Electrobacteriando"(2012) which had several nominations in the Cuban TV awards for musical video clips, and the "Convergencias" workshops (2010) organized by Prof. Hugo Pérez Rojas, the poet Victor Fowler and the anthropologist Jesús Guanche. Other such activities include the publication of scientific divulgation articles, holding public conference cycles and maintaining an active presence on social media.

Along the years the group has had to overcome various

difficulties, including the sometimes excessive bureaucracy, the brain drain due to economic pressures, a permanent lack of financial resources, and the hostility of those who do not understand the importance of having other than applied research in Cuba. In this environment, the DFT survived thanks to the will of its members and their conviction that developing fundamental science is essential for social and economical advancement. In the words of Dr. Alejandro Cabo Montes de Oca, "(...) in the absence of the DFT the physics in Cuba would have been amputated from studies focused on the most basic methodology of contemporary theoretical physics".

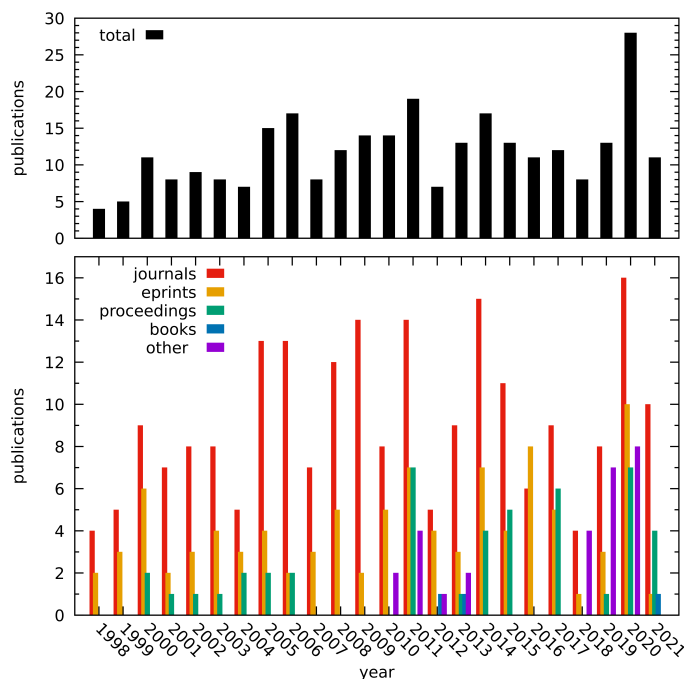


Figure 2. Summary of DFT publications from 1998 to 2021.

Another reason for the survival of the department is its pleasant work environment, as reflected in the survey, where most interviewees highlighted the positive impact of their transit through the DFT in their personal and professional lives. For Lidice Cruz Rodríguez, who was a master student at the group, the DFT was her first real research experience: "I not only followed the guidelines of my advisors but also contributed with my ideas and criteria, which to my surprise were listened. Whenever I think of a place where I really enjoyed working, my afternoons at DFT come to mind". Efraín Ferrer, former member of the DFT, states "in the Cuba of the 80's it was like an intellectual oasis. It gathered a small group of young scientists, full of energy and plans, who devoted themselves intensely to grow as researchers. (...) we spent days talking about sums in p four, renormalizations, condensates and chemical potentials..."

Nowadays, the DFT continues to be this oasis where young Cuban physicists go to learn general relativity and particle physics, where the focus is always on the science and the people that make it.

