

Forty-five 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.

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 both 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 ININTEF (National Institute of Fundamental Investigations, today nonexistent). Hence, in March 1976, the Group of Theoretical Physics was born. After 45 years and several changes of denomination, location, and affiliation, the Group of Theoretical Physics still works under the leadership and inspiration of Professor Hugo.

Currently, the group is located at the intersection of E and 15th streets in Vedado, Havana, and it is known as the Department of Theoretical Physics (DFT after its acronym in Spanish), of the Institute of Cybernetics, Mathematics, and Physics (ICIMAF). The DFT is composed by fourteen full-time researchers from senior investigators to graduate students, six regular collaborators from other institutions, and seven Bachelor in Physics undergraduate students from the University of Havana. Its scientific activity revolves around the senior researchers, Dr. Hugo Pérez Rojas, Dr. Alejandro Cabo Montes de Oca, Dr. Augusto González, Dr. Aurora Pérez Martínez, and Dr. Elizabeth Rodríguez Querts. Over time, its initial scope expanded from finite-temperature quantum field theory to other areas such as condensed matter physics, high energy physics, gravitation, astrophysics and biophysics, to name a few. The research reports gathered in these proceedings show a sample of such diversity.

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 so-



Figure 1: Some of the current 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 Vidaurrreta, 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 Daryl Manreza Paret; Samantha López Pérez and José Carlos Suárez Cortina.

cialist block, new bonds have been established since then between the DFT and several prestigious international research institutions like the ICTP in Italy, the CINVESTAV in Mexico, the FIAS in Germany and the TWASS. While processing the interviews with the members of the DFT we counted the existence of scientific links with more than twenty-three research centers and universities of sixteen countries.

As a result of its academic activity, the DFT accumulates more than 300 peer-reviewed scientific publications (Figure 2), more than sixty thesis from bachelor to Ph.D., and more than twenty collective research awards given by the ACC, Cuban Agency for Nuclear Energy and Advanced Technologies (AENTA). Several of its members have received important national

and international recognitions. Dr. Hugo Pérez Rojas (2011), Dr. Alejandro Cabo Montes de Oca (2012), and Dr. Augusto Gozález (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.

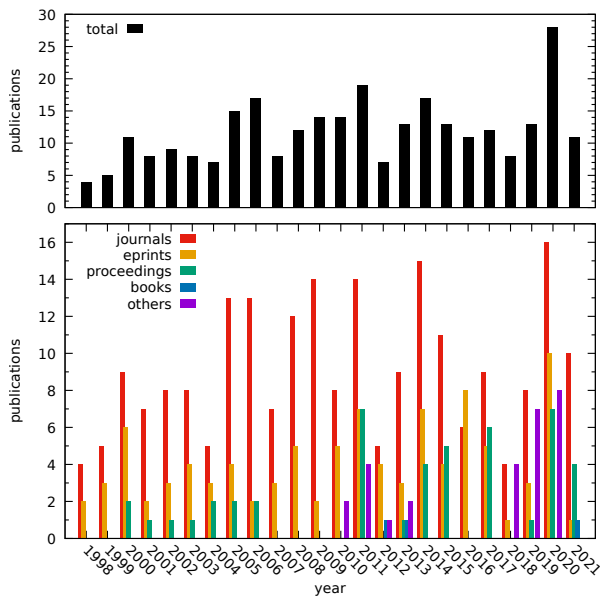


Figure 2: Summary of DFT publications since 1998.

Besides, the DFT is known for the high quality of the conferences it holds with great frequency. The international conference STARS/SMFNS, organized every other year since 2003, is one of the biggest physics event in the country and the only one devoted to astrophysics. The STARS/SMFS preschool is waited with special interest by the students, while the Latin-American Conferences on High Energy Physics, Particles and Strings, are remembered as one of the best events they ever attended by many DFT members.

In parallel to research, the DFT has active participation in Physics education and promotion. 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, and 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.

The DFT also made its presence noticeable through its participation in many outreach activities. Among these activities some stand out like the exhibition on intervened microscopy photos, "Paisajes del micromundo" (2011) and the video clip "Electrobacteriando" (2012) which won several nominations in the annual Lucas Awards. Besides that, Prof. Hugo Pérez Rojas together with the poet Victor Fowler and the anthropologist Jesús Guanche organized in 2010 a series of memorable workshops called "Convergencias". Other such activities include publication of scientific dissemination articles, holding 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 some bureaucrats and scientists who do not understand the importance of having other than applied research in Cuba. In this environment, the DFT has survived thanks to the will of its members and their conviction that developing basic science is essential for social and economical advancement. Besides, in 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".

Another reason to the survival of the DFT is the pleasant work environment created thanks to the outstanding humility and professional quality of its leaders. This was reflected in the survey filled by the participants of the FT-45, where almost all of the interviewed highlighted the positive impact of their transit through the DFT in their personal and professional lives.

For Lídice 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 contribute 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.

Notes

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