

# Personal Notes about the History of the Theoretical Physics Department

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*A personal view of the history of the Theoretical Physics Department (DFT) at ICIMAF (former ININTEF) is presented. The current Department was originally called Theoretical Physics Group (GFT).*

After I graduated from the University of Havana in 1970, I was assigned to the Department of Magnetism of its College of Physics. Once I had defended my master thesis, given my previous interest in theoretical physics, I openly approached Prof. Hugo Pérez Rojas, who by that time had already founded the Theoretical Physics Group (GFT) at the Fundamental Technical Research Institute (ININTEF). It's imperative to acknowledge that the foundation of the group was strongly supported by Prof. José Altschuler Gutwert, the then vice-president of the Cuban Academy of Sciences, which was the institution that the ININTEF was attached to. I remember distinctly that earlier in my career, when I was still a Physics undergrad student, during an exam in Prof. Hugo's course he invited me to join the GFT which at that moment it was still in the works. When I came to ININTEF in 1977, some colleagues were already part of the group:

1. Ricardo Arrieta, a Salvadorian UC Berkeley graduate, who at that time was working on a theory of particle masses and who disappeared on his way back to Berkeley while stopping in El Salvador.

2. Ramón Rubio, a very skillful Cuban mathematician that came to the group thanks to José Altschuler, after leading the Faculty of Mathematics of UH. Ramón was working in a French university when he decided to come to Havana to teach, along with other renowned French mathematicians, a series of summer courses.

3. Eduardo Casado, a Physics graduate recently demobilized from the army who was supervised by Oleg K. Kalashnikov on his thesis about a Quantum Chromodynamics (QCD) related topic.

4. Vivian de la Incera and Efraín Ferrer, Physics graduates from UH, which were initially assigned to the Pedagogical Institute of Pinar del Río and later transferred to the group. They worked jointly with A. E. Shabad and E. Fradkin on subjects related to Quantum Field Theory (QFT) at finite temperature.

5. Augusto González, that entered the group right after finishing his major in Physics at UH. Augusto initially started working with Hugo but then he went to the Lebedev Physical Institute in Moscow to complete his degree.

Follows below, the timeline of the GFT:

1. First of all, it was founded in the 70s by Prof.

Hugo, and was decisively supported by the then vice-president of the ACC, Prof. José Altschuler Gutwert.

2. Then, the establishment, in the 70s as well, of the collaboration with the Lebedev Physical Institute from the Russian Academy of Sciences. This allowed through graduate studies and research visits, the accelerated training of the first members of the group. During that period H. Pérez, A. Cabo, V. de la Incera, E. Ferrer and A. González obtained their doctorate degrees. Hugo Pérez under the supervision of Efim S. Fradkin and Anatoli E. Shabad, studying the electromagnetic response of the electrodynamic plasma at finite temperature and density, a topic that has continued to expand during the 45 years of DFT's existence. On the other hand, the goal of my thesis was to quantify gauge fields on the presence of external sources, as well as to study the phase transitions at finite temperature and density for those types of fields. Since those days, my research activity has grown to include topics from Gravitation to Condensed Matter like the Quantum Hall Effect and superconductors at high temperature. In the early 90s, the support from the Lebedev Institute substantially dropped. Nevertheless, we started to establish new collaborations and to gain the assistance of other institutions.

3. Subsequently, in the 90s, the collaboration with the International Centre for Theoretical Physics (ICTP) notably fueled our research work through participation in events and research visits to the centre. Some of our researchers were also appointed as Senior and Regular associate members.

4. It was also in this period when we started collaborating with Mexican Institutions. The contact was initially established during one of my visits to ICTP where I met Dr. Arnulfo Zepeda from the Center for Research and Advanced Studies of the National Polytechnic Institute (CINVESTAV). Many research visits by physicists, mathematicians, and engineers followed. During that period, Dr. H. Pérez and myself held research chairs (cátedras patrimoniales) of the National Council of Science and Technology (CONACYT), CINVESTAV, and the University of Guanajuato.

5. The group also highly benefited from the partnership with the Finish professor Masud Chaichian. Collaborations with almost all members of the group allowed many research visits: H. Pérez, A. Cabo, V. de

la Incera, E. Ferrer, R. González Felipe, and D. Louis spent time at his home institution during that period.

6. It was also extremely beneficial to our group the academic cooperation established by Augusto with several Colombian universities, in particular, with the University of Medellin. His efforts training young Colombian physicists were highly valued in this country.

7. During the first decade of this century, and due to the successful research work carried on by A. Pérez in Astrophysics, new fellowships with Mexico, Brazil, Italy, and Germany were established. Moreover, under her leadership young Cuban physicists have been able to complete their doctorate degrees studying the physics of compact objects. Among them, we would like to mention, Gretel Quintero and Daryel Manreza.

### Collaborators and students

Before I end this historical review, I would like to recognize some of the people and researchers that have contributed to sustaining the work of the DFT during the 45 years of its existence. This list is far from complete:

1. Dr. José Altshuler Gutwert.

2. Dr. Efim Samoilovich Fradkin, the corresponding member of the USSR Academy of Sciences that accepted the proposal of collaboration brought up by Hugo Pérez during his first trip to USSR in the 70s and who then acted as his Ph.D. supervisor.

3. Dr. Anatoli Efimovich Shabad, Fradkin's student who also supervised H. Pérez, V. de la Incera and E. Ferrer as mentioned before. On top of that, my collaboration with Shabad led to the completion of my thesis in 1982. I would like to point out that the numerous visits of Shabad during the 80s contributed very positively to the formation of the members of the GFT.

4. Dr. Oleg K. Kalashnikov, another student of Fradkin who visited our country on the early 80s. He advised Eduardo Casado's thesis on QCD. Kalashnikov, Shabad and I wrote two papers about chiral phase transitions and deconfinement in QCD.

5. Dr. David A. Kirzhnits, a remarkable researcher from the Lebedev Institute, who made a very important discovery in high energy physics with Andrei Linde and who from Moscow supervised the doctorate thesis of Augusto González. Augusto later went to the Lebedev Institute to complete his doctorate degree.

6. Dr. Seifallah Randjbar-Daemi, the Iranian Research Director of ICTP for many years, who strongly supported the appointment of H. Pérez, A. Cabo, A. González and A. Pérez as associate members of ICTP. This status gave us the possibility of visiting ICTP, with all expenses covered, three times for three months during a period of six years. Furthermore, he played a key role on the approval of ICIMAF as part of the Federation Agreements, which in turn allowed an additional number of research visits to the centre per year by members of the group.

7. The late Dr. Arnulfo Zepeda, one of the main researchers at CINVESTAV (Mexico) on Particle Physics

and a crucial figure setting the partnerships with Mexican Institutions.

8. Dr. José Luis Lucio from University of Guanajuato, with whom I worked when I had the research chair of CONACYT. It was also at his institution where our late dear friend and colleague Luis A. Delpino defended his Ph.D. thesis.

9. Dr. Francisco Claro, professor of the Pontifical Catholic University of Chile with whom I collaborated during the years 2000-2008 on research topics related to the Fractional Quantum Hall Effect that were funded by the National Commission of Scientific Research and Technology (CONICYT).

On the following we list the collaborators from the two thousands that Aurora facilitated the contact. All these researchers published several papers with different authors from our department.

10. Dr. Herman Cuesta Mosquera (Brazilian Centre for Physics Research), who worked with Hugo, Aurora and their students on Astrophysics topics.

11. Dr. Roberto Sussman (National University of Mexico (UNAM)), who worked with Aurora and her group on topics of stellar structures.

12. Dr. Miguel Socolovski (UNAM), who has worked with Hugo and myself.

13. Dr. Gabriela Piccineli (UNAM), who besides collaborating with Aurora's group has paid many visits to our department.

14. Dr. Jorge Horvath, professor from the Geophysics and Astronomy Institute of the Federal University of São Paulo, where Daryel Manreza completed Postdoctoral research work.

15. Dr. Alejandro Ayala (UNAM), who has intensely collaborated with Manreza and Aurora in the recent years. Daryel also had a postdoc position at UNAM.

Next I would like also to recognize our many Diploma, Master and Doctorate students. Some of them are: D. Oliva, D. Louis, S. Peñaranda, J. Castiñeiras, F. Morales, R. Martínez, D. Martínez, S. Villalba, E. Rodríguez, I. Cabrera, L. A. Delpino, A. Ullacia, A. Burke, A. Correa, M. Rigol, P. Fileviez, O. P. Fernández, Z. González, L. Vaillant, N. G. Cabo Bizet, A. Cabo Bizet, G. Gil, V. Martínez, Y. Vielza, M. Boli-gan, D. Albear, D. León, F. Quintela, L. Suárez, D. López, D. Suárez, S. López, D. Luis and others, whom I ask to excuse the omission.

To conclude I would like to acknowledge three dear former members who have continuously supported the organization of international events in our center. These events have substantially contributed to the international recognition of our department. First and foremost, Ricardo González Felipe, who has organized the biannual events STARS-SMNFS, attended by leading international astrophysicists. Lastly, Sian-nah Peñaranda and Francisco Morales, who have organized the Latin-American Conferences on Particles and Strings, which have also been attended by remarkable scientists in String Theory and High Energy Physics.