

Efim S. FRADKIN and his contribution to Cuban physics

by Hugo Celso Perez Rojas

The Cuban Academy of Sciences started in 1973 an active collaboration with Academy of Sciences of Socialist countries, in particular with Academy of Sciences of the URSS. I was teaching Physics at the University of Havana, and being interested in research work in Theoretical Physics, decided to move to the Institute of Fundamental Technical Research (ININTEF) since 1972, and thanks of the support of Professor Jose Altshuler, ININTEF Director, I applied to a grant for a Doctoral degree. The administrative office of the Cuban Academy delayed the application of my travel, and it was planned to be done on first days of Summer of 1974.

As we have had some contacts with some scientists coming from Ioffe Institute at Leningrad, who suggested to visit them, we asked to start the visit going directly to Leningrad, after arriving to Moscow. But, when arriving to Moscow, I was surprised when the person from the URSS Academy of Sciences I met in the of Moscow airport told me about a change of the previous plan: colleagues from the Academy in Leningrad claimed that accomodation there was saturated and asked not to send me and other visitors to Leningrad. By that reason the Academy in Moscow offered easy accomodation for me at the Academy Hotel, and contacted some scientific leaders at the Institute of Physics P.N. Lebedev, which was, and it is, a very famous center of Science

Fortunately although it was time for Summer holidays some members of FIAN Scientific staff were yet in Moscow. I was able to visit FIAN accompanied by Ms. N. Subbotina, from the collaboration office of the Academy of Sciences in Moscow. We met first Professor V. Fainberg, who gladly accompanied us to Professor Efim S. Fradkin office. He immediately expressed his disposal to advice research to a Cuban visitor.

Professor Efim S. Fradkin asked me about my scientific interests, and I told him that quantum statistics and quantum field theory. He said me "you must use one common method for both..." and provided me a copy of his book entitled Quantum Field Theory and Hydrodynamics. In it he developed the basic ideas of extending Green's functions method from both quantum field theory to quantum statistics.

I had around three months to study the book he provided to me. The book has a lot of information in a short space, and at first glance I understood some parts. But I needed a specific oroblem task to apply the methods suggested by Professor Fradkin on a specific problem, after he returned early in September

He proposed me a task to start calculations and I carried out it after returning to Havana at the beginning of September 1974. I could visit again FIAN at the end of 1974 and first days of 1995 (as a member of a Cuban group participating in a scientific meeting of Intercosmos, which was not related with my research on theoretical physics at FIAN). But it was not difficult to find time to have short meetings with Professor Fradkin and Dr. Shabad at FIAN.

Dr. Shabad had made a deep study about propagation of photons in vacuum in a strong magnetic field, where virtual electron- positron pairs perturb the photon propagation, which leads to a diagram containing the polarization operator. What Prof. Fradkin proposed me was to extend the study to the more general problem of the case of photon propagation in a medium at nonzero temperature and real electron – positron gas. To do it I started the task of extending the calculations to the temperature case, by including with the interaction with a real electron-positron plasma at nonzero temperature and densities. I visited FIAN in 1975, 1976, 1977, and with Dr. Shabad, published three papers containing new results. I was in conditions of writing and defending the Candidate thesis. This was done on Dec. 1978 at FIAN.

I am proud of having had as First advisor of my Ph. D. Thesis to one of the most brilliant minds, of the 20 Century as it was Academician Efim S. Fradkin. But I want to stress also the strong advice and collaboration from Dr. Anatoly Shabad, with whom I shared three fundamental papers.

But two other young members of the Theoretical Physics Department of our Cuban Institute ININTEF got their Ph. D. in the Department of Physics of FIAN, which were

- 1) Alejandro Cabo Montes de Oca, advisor: A. E. Shabad (defended 1982)
- 2) Augusto Gonzalez García, Advisor : A.D. Kirzhnits (defended 1990)

I thank Fradkin for ever for his disposal to contributing to the increase of collaboration among FIAN and ININTEF in Havana in the important field of Theoretical Physics which is modern quantum field theory at nonzero temperature and density applied to problems of high energy physics and astrophysics

Such increase of our Department of Theoretical Physics group was continued with the promotion of two young woman physicists active in research, which at present is very important as the Second Generation of the Theoretical Physics Department from ICIMAF (new name of earlier ININTEF)

The women were (at present they are leaders) are:

- 3) Aurora Perez Martinez, Advisors Alejandro Cabo and H. Perez Rojas (defended 1994 )
- 4) Elizabeth Rodríguez Querts, Advisor H. Pérez Rojas (defended 2010).

several students and teachers from the University of Havana have also defended M. Sc. and Ph. D. degrees in our Department of Theoretical Physics.

Prof. Fradkin wanted to visit Cuba and we invited him to come, but it was not possible at the end, to arrange it. However, Dr. Shabad visited our Institute several times.

I hope that doors open in both sides, which were open first by Professor Fradkin around 50 years ago, could in a next future be re-open for present generations in the frame of theoretical physics.

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