

The Current State of Physics in Cuba: A Personal Perspective

By Marcelo Alonso

After 40 years of absence I returned twice to Cuba, in January and December of 2000, to participate as a guest lecturer in two international scientific meetings. The first dealt with Physics Education, and the second with current issues related to Quantum Mechanics. In addition to a few participants from Europe, US and Latin America, the two meetings were well attended by Cuban physicists.



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International meetings are very useful for Cuban physicists, whose travel possibilities are limited unless financed by foreign sources, and thus offer them the opportunity to interact with foreign colleagues. For me the meetings were very helpful because I could talk at length with several Cuban physicists, allowing me to get first-hand information about physics education and research. Both have changed during my absence. Prior to 1959 there were three official universities, Habana, Central and Oriente, and one private, Villanueva. Now there are several official universities, polytechnic institutes and pedagogical institutes, so higher education is much more diversified. Only two universities in Cuba offer a degree in physics: the University of Habana, in Habana, and the University of Oriente, in Santiago, although other universities offer physics courses for students of Chemistry, Engineering, Biology, etc.

On both occasions I was able to visit the University of Habana, where I had been professor of Theoretical Physics until 1960. The main campus, on a hill, with neoclassical architecture, remains the same except that the use of some buildings has changed because the academic structure of the University has also changed. Unfortunately the buildings are not well maintained, but that is a general problem in Cuba.

I found that since my time the physics curriculum in the University of Habana has been reorganized substantially and the academic staff expanded considerably. The Faculty of Physics, headed by a Dean, consists of three Departments: General Physics, Theoretical Physics, and Applied Physics, with a total academic staff of 69 persons with about 40 holding a PhD. The Faculty offers a 5-year "licenciado" which has a level between bachelors and masters degrees in the US. Beginning with the third year, students must work in some laboratory, and at the end of the 5th year students must submit a thesis in order to obtain their diploma. Masters and PhD. degrees are also offered, that are to a great extent comparable to the US. At least a Masters degree is required to teach in a University. My general impression is that the physics students (currently about 100) and the staff are very well prepared, in spite of severe limitations in resources (equipment and library).

In many cases students can take graduate courses or do their Masters or PhD. thesis in some of the research institutes that operate under the Academy of Sciences, such as the Institute for Cybernetics, Applied Mathematics and Physics (ICIMAF) and the Advanced Institute for Nuclear Science and Technology (ISCTN) that offers 5-years "licenciado" and PhD degrees in Nuclear Physics and in Nuclear Engineering.

In addition to the two universities and research centers offering advanced physics degrees, there are 16 Higher Pedagogical Institutes that offer a 5-years "licenciado" degree in Education with specialization in Physics Education. This degree is required to teach physics in secondary schools, although university physics students must take courses on the pedagogy of physics, just in case they decide to teach.

After graduation a student must work up to two years in some government research center or equivalent (social work). In addition to the physics courses, students must take courses with social and political content, a tradition inherited from former Soviet universities.

During the period of Soviet influence in Cuba, from the early 60's until the demise of the Soviet Union, many Cuban scientists were trained in Russian centers, mostly in Moscow and St. Petersburg (formerly Leningrad), as well as in some East European countries, such as Hungary. The Cuban scientific establishment was patterned after the Soviet organization of science, with universities and technological institutes providing mainly scientific and engineering education, and most of research done in specialized governmental institutes operating under the Cuban Academy of Sciences, the Ministry of Science, Technology and Environment, or other government agencies. This structure still exists.

In a centrally planned and operated economy as is the Cuban system, all job opportunities are in governmental institutions. To be considered for a position (research and teaching) in a university, the "licenciados" in Physics must have graduated with an average of at least 4.0 points out of 5.0, and must take advanced courses related to pedagogy in the areas in which they will teach. Cuban physicists work in research centers of the Ministry of Science, Technology and Environment and other government agencies, in hospitals and biomedical research centers, and in industrial and technical services. The main fields in which Cuban physicists work are (1) optics, lasers and spectroscopy, (2) condensed matter and materials physics, (3) electronics and computation, (4) non-conventional energies, mostly solar, (5) biophysics and medical physics, (6) geosciences, (7) theoretical physics (complex systems, cybernetics, particle physics, field theory, etc.), (8) nuclear physics, (9) teaching, and (10) physics education research at all levels. In some instances it is a combination of fields.

Currently there are in Cuba about 1600 physicists, of which about 180 are PhD's, and about 700 are engaged in research. The Cuban Physical Society has about 500 members, and publishes the Cuban Journal of Physics, three issues per year. Other technical journals, some of popular nature as "Energy and You" (Energía y Tú) published by CubaSolar and "Nucleus" published by the ISCTN are available. Beside research physics

y, is sponsored by CERN and "Nuclear" sponsored by the ECET, and elsewhere. Science research, physics education at all levels receives special attention and several semi-popular journals have that orientation.

An important difference with the US is that ALL students when they finish secondary (high) school have taken physics. In elementary school students start taking science courses, with some physics content, in the third grade. However physics as an "obligatory" course for secondary (high) school students is taught in grades 7 through 12. All physics teachers in secondary schools must be "licenciados" in Physics Education, graduated from a Higher Pedagogical Institute. Thus in spite of possible deficiencies in laboratory and computing equipment, secondary (high) school graduates are much better prepared in physics (as well as in mathematics and other subjects) than their counterparts in the US.

If I am asked what is the best way to help physicists in Cuba, I would recommend as the first priority to establish a modest fund to invite Cuban physicists to attend conferences and seminars in the US, and to teach one semester courses or work with a research group in US academic institutions. Considering how inexpensive travel is between Miami and Havana (\$300 round trip) I assume that the amount needed per individual physicist would be of the order of \$2,000 to \$5,000 depending on the place and length of stay. Organizing seminars in Cuba, in which US physicists would participate, is my other priority. I hope very much that funds for these two purposes can be found.

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