Marcos Moshinsky –teacher, colleague, scientist

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Abstract. It is said that a man lives every time his name is pronounced, when his ideas are discussed, and when the result of his actions continues to benefit the community. In this regard, Marcos Moshinsky will be in the midst of our generation of students and colleagues as we often refer to his careful instruction and generous collaboration. And beyond, his name will be remembered for as long as his seminal works on quantum and nuclear physics, group theoretical methods, and mathematics, remain in the foundations of the edifice of science.

1. A child comes to Mexico, a student goes to Princeton, a scientist matures

Marcos Moshinsky was born in Kiev, Ukraine, in the spring of 1921 during very difficult times. His father, Israel Moshinsky, managed to escape with his family first to British Palestine, and then to Mexico, whose government was then fostering the influx of European migrants. As many refugees from a broken Europe, in time and with hard work he prospered and contributed generously to the community by funding the building of the Colegio Israelita in the 1940s, among other donations through the years.

Marcos was among the first students to graduate in Physics from the Facultad de Ciencias of the Universidad Nacional Autónoma de México (UNAM), which was then lodged at the School of Mining, a late eighteenth-century Borbonic building in downtown Mexico City. His B.Sc. thesis director was Dr. Manuel Sandoval Vallarta, who was also Professor at M.I.T. and had a prominent role in the study of cosmic rays. The young Marcos spent some months in Sandoval Vallarta's laboratory, housed on the School's rooftop, registering the crackling sound of a detector. He enjoyed telling us that he had become very excited when he noticed an almost-periodic increase in flux every 10 minutes or so. Could this be an important phenomenon at low latitudes? Was it some kind of a resonance? Then he would laugh: *No, it was the electric tram that passed by the street below*. Probably then he decided to be a theoretician.

Another anecdote that should not be lost concerns his doctoral studies in Princeton, recommended by Prof. Sandoval Vallarta. This was late 1947, when communism was starting to raise fear in the hearts of the U.S. administration. Marcos acted out the scene as told me of the occasion when he applied for a student visa at the embassy. *Born in Kiev? hmm…* Yes. *What do you want to study?*

Nuclear physics. …*No!* shouted the clerk as if he were Senator Mc Carthy himself. Eventually, Prof. Sandoval Vallarta obtained for his student a diplomatic passport, and thus Marcos was able to reach

Princeton, to study under Eugene Wigner and contribute with him, and with Valentin Bargmann, several cornerstones of group theory and nuclear science.

By talent and circumstance, Marcos Moshinsky participated in the birth of many Mexican scientific institutions, such as the Sociedad Mexicana de Física, the Academia Mexicana de Ciencias, the Escuela Latino Americana de Física, the Revista Mexicana de Física, and the Centro Internacional de Ciencias (CIC), here in Cuernavaca, on which I will write some lines below. He was also a forceful figure behind the scenes, being widely known and respected by university rectors and government officials. Yet he always remained "a civilian," that is, he never had academic-administrative duties such a directorship (incongruously reserved by UNAM's statutes only to Mexicans by birth…), or other managerial tasks beyond the occasional organization of schools and conferences. Yet he became, surely in spite of himself, the popular icon of what a Mexican scientist looks like. The official school calendar issued by the Ministry of Public Education bears his photograph this year.

2. The teacher

As we started in the 1960s to learn physics at the Facultad de Ciencias of UNAM, in the new Ciudad Universitaria, we knew that during the senior year the course in Quantum Mechanics would be taught by Moshinsky. We trepidated as he entered the lecture room for the first time, but rather quickly realized that, even though he sometimes appeared formal and dour, his strictness resided in the treatment of this difficult subject in a precise and honest manner, and not at all in his person, who was very –very– human. I quote Alejandro Frank, one of his former students, who condenses Marcos' style of teaching: *Sometimes our questions were quite naïve, but Marcos pondered on them, and often he came with a different, deeper interpretation that rescued our query from total inanity.* And Marcos' view of his charges: *Scientific education is like a tennis match; at first, the student will return the ball in simple and predictable ways, but then you may have the pleasure of detecting talent when on occasion you see him answer with a strong hit in an unexpected direction*.

Many of us did our theses under his guidance, and now there are second and third generations of Moshinsky students; his grandstudents. Personally, I decided to continue my Ph.D. studies in Israel and do my postdoc in Sweden, but on returning to Mexico I came rather naturally to collaborate with Marcos on hidden symmetries and on canonical transformations. Then came years when our interests lost direct contact, but as with his other colleagues and former students, when a hard research problem appeared, we would discuss it with Marcos, who had the knack of asking the right questions and to find the essence of the problem in a simpler model –very often in the harmonic oscillator. As he used to say: *Two types of problems exist in quantum mechanics, those that you cannot solve and the harmonic oscillator. The trick is to push a problem from one category to the other*.

3. The role of Marcos Moshinsky toward the Centro Internacional de Ciencias –Cuernavaca

In 1980 Mexico had good fortune, with high oil prices and several intelligent people with scientific training in the Ministry of Public Education. It was the brainchild of Jorge Flores and Edmundo de Alba to set up in Cuernavaca a center for scientific meetings on the model of the International Centre for Theoretical Physics, then directed by Prof. Abdus Salam, which had established its home in Miramare, Trieste. Professor Moshinsky was offered the role of founding director; for his own reasons he declined, but kept close to the project during subsequent meetings with international functionaries, to which he invited me. It would be called CIFMO: Centro Internacional de Física y Matemáticas Orientadas (the term 'orientadas' –never fully defined– would be later changed to `aplicadas', which makes more sense). During the ninth group theory Coloquium (ICGTMP-1980), which Marcos Moshinsky and a group of us organized in Cocoyoc, I suggested to him that this would be the best

forum to announce the International Center project. Rather wryly he told me: *be skeptical of such projects in this country, and take nothing for granted until it actually breathes*. And he was right, because the project was not put into the best hands, was deviated from its purpose and thus delayed; by the end of 1982 it fell prey to the economic crisis of that year and the change of administration. In 1984 the CIFMO project was revived, but in 1986 again it was nixed by superior ignorances.

Fed up with this dithering, among the original promoters of the project it was decided in December 1986 to set up the Cuernavaca Center as an Asociación Civil, independent of governmental patronage. Professor Moshinsky accepted to be President of the association and, in my view, he was the rock of its existence. During each of the following eight years CIFMA convened three or four national and international meetings on physics, mathematics, and several other related venues. For each event we requested and obtained funds from a variety of sources (UNAM, CONACyT, PEMEX, ICTP, IAEA, IUPAP, IAMP, NSF, and others). During that time, CIFMA was in two drawers of my desk at the UNAM campus in Cuernavaca, but we had the beautifully efficient help of Mrs. Petra Seligman, our indispensable and unforgettable administrator. We took care not to burden Marcos with micro-administration or crisis control; things were done as he would have approved, and his trust was always generous and firm.

During the summer of 1989, the Moshinsky family –Marcos and his sisters, Estela de Klip and Ruth de Rosengauss– gave the crucial support and momentum to turn CIFMA into the fully fledged Centro Internacional de Ciencias (as it is called since 1996), by offering the fund that their father Israel had bequeathed for the advancement of science in Mexico, as seed money to construct the excellent installations that CIC has now in Cuernavaca. I had first to find a good location –providentially provided by UNAM in commodatum at its joint campus with the Universidad Autónoma del Estado de Morelos (UAEM)– and then concurrent funds from UNAM and several private donors. Thus the building was inaugurated on May 25, 1996, with the presence of the rectors of UNAM, UAEM, and the state governor.

With the subsequent directors, Federico Sánchez, Thomas Seligman, and Marco José, CIC has focused its activities in *gatherings* rather than conferences. These gatherings convene small groups of scientists, nationals and visitors, active researchers and postdocs, for two or three weeks of close interaction; Marcos Moshinsky was often there and always a welcome guest.

4. The scientist

The contributions that Professor Moshinsky made to science are witness to his lasting presence among us and future generations. Many of them are well known to the participants of the Bregenz meetings on Symmetry in Science, which he rarely missed when convened by Bruno Gruber, and now by Dieter Schuch. A long time companion of Marcos Moshinsky, Professor Yuri F. Smirnov, is also remembered in these Proceedings; they formed a powerful team during the years they worked together on their book [1], a *tour de force* through the methods and results of group theory in n-body quantum systems. The last third of the book is devoted to the Dirac oscillator; it cannot be an accident that the Dirac equation, besides applying to the free particle, electromagnetism and the hydrogen atom, also describes systems with oscillator interparticle potentials. The expectation we all had was that this model would explain the hadron spectrum, which it did not; but to my biased understanding, Nature cannot let its elegance remain unrealized.

Foremost, Marcos Moshinsky was a researcher. Yet I would defer this fundamental aspect of his activity to the Laudatio written by Pavel Winternitz for the occasion of the Wigner Medal ceremony at

the Group22 Colloquium, held in Hobart in July 1998 [2,3]. *I can think of only a few examples where the creation of a school of modern physics in a country can be attributed to one person. A person who has the necessary scientific talent, but also the correct personality to create a school. That is to devote time and attention to students, attract collaborators, influence authorities, generate ideas for many to work on, and in general, create a fruitful scientific and human atmosphere. Examples that come to mind are Enrico Fermi in Italy, Leopold Infeld in Poland, and Marcos Moshinsky in Mexico.*

During his long life, Marcos Moshinsky was awarded all Mexican scientific prizes and many international ones, including the 1988 Príncipe de Asturias prize by Spain, the 1991 Andrei Sakharov Medal for Human Rights, the 1997 UNESCO prize for Scientific Research, and the 1998 Wigner Medal. He was member by invitation to scientific academies of Argentina, Brazil, the E.U., U.S., TWAS, and the Vatican, and welcomed as Doctor Honoris Causa in several universities, including the Goethe University in Frankfurt. This recognition of the man means more than any count of articles, citations, H-numbers, or other numerical indicators for reports to which many of us have had to bow.

5. A pearl of wisdom

Certain events we lived through in our youth come back as blessed bits of wisdom. Years ago, as I was in Benares, it happened that I stumbled across a funeral procession and willingly joined the crowd on its way to the river Ganges. There were flowers, music and chanting; nobody seemed to be mourning at all. I asked for whom was this ceremony held; it was the matriarch, the mother, grandmother and great-grandmother of a large clan of the city's weavers. *One should not be saddened by the inevitable*, they told me, *and we are happy because we see the numerous progeny in which she continues to live*. We thus know that Marcos lives on in us.

References

[1] M. Moshinsky and Yu.F. Smirnov, *The Harmonic Oscillator in Modern Physics* (Hardwood Academic Publishers, 1996).

[2] *Group22. Proceedings of the XXII International Colloquium on Group Theoretical Methods in Physics*, Ed. by S.P. Corney, R. Delbourgo, and P.D. Jarvis (International Press Inc., Boston, 1999), pp. xvi-xxi.

[3] *Testimonios. Marcos Moshinsky: 80 Años de Vida y 60 Años de Trabajo Científico*, Ed. by A. Frank and K.B. Wolf (CIC-UNAM, México DF, 2001), pp. 160-165.

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