



## Prof. Marcos Moshinsky

Professor at the Universidad Nacional Autónoma de México



### **Most important awards, prizes and academies**

*Awards:* Academia de la Investigación Científica (1961); Fomento Educativo (1966); National Science Prize (1968); Luis Elizondo (1971); Research Prize – Universidad Nacional Autónoma de México (1985); Bernardo A. Houssay, Organization of American States (1990); UNESCO Science (1997); Wigner Medal (1998); The Weizmann Award in Science and Humanities (2003). *Academies:* President (1962-63), Academia de la Investigación Científica, México (1960-); Academia Brasileira de Ciências (1963); President, Sociedad Mexicana de Física (1967- 69); El Colegio Nacional, México (1972); Academia Latinoamericana de Ciencias (1963); Third World Academy of Sciences (1985); Pontifical Academy of Sciences (1986); American Academy of Arts and Sciences. *Honorary Degrees:* Goethe University, Frankfurt, Germany (2000).

### **Summary of scientific research**

After receiving his Ph.D. in Princeton in 1949 working with Wigner on 'Boundary conditions for the description of relativistic interactions', his interest turned to a schematic theory of nuclear reactions with the help of these boundary conditions and the possibility of a time dependent description of the scattering and reaction process. Later he became interested in nuclear structure problems

based on the shell model, and in particular ways of simplifying the calculations through the concept of transformation brackets for harmonic oscillator states. This concept became a basic tool in nuclear shell and Hartree-Fock calculations. His interest in harmonic oscillator states led him to try to understand their underlying group structure and thus to the irreducible representations of the unitary groups and their applications, first in 2s-1d shell and later in collective models of the nucleus. This continues to be an interest of his, though at that point through the symplectic Lie algebras related to the microscopic understandings of the collective motions. Along the way he became interested in the representation of canonical transformations in quantum mechanics, particularly when those transformations were non-bijective as it happened in the case of action and angle variables. This gave rise to many publications and was also an interest he continued until his death. A line of research he initiated concerned the structure of matter in strong electric and magnetic fields. He was also concerned with problems of relativistic quantum mechanics through the introduction of a new concept he called sign spin.

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### Main publications

*Books:* Moshinsky, M., *Tables of Transformation Brackets* (with Brody, T.A.), Gordon and Breach, 1969; Moshinsky, M., *Group Theory and the Many Body Problem*, Gordon and Breach, 1967; Moshinsky, M., *The Harmonic Oscillator in Modern Physics: From Atoms to Quarks*, Gordon and Breach, 1969, Russian trans. by MIR in 1972; Moshinsky, M., *The Harmonic Oscillator in Modern Physics* (with Smirnov, Yu.F.), second enlarged edition, Harwood Academic Publishers (1996). Over 275 *research papers* most of them in international journals. Among the most recent ones: Moshinsky, M., 'Boundary conditions for the description of nuclear reactions and their time dependent behavior', *Phys. Rev.*, 81, p. 347 (1951); 84, pp. 525-33 (1951); 88, p. 625 (1952); Moshinsky, M., 'Transformation brackets for harmonic oscillator functions', *Nuclear Physics*, 13, p. 104 (1959); Moshinsky, M., 'Group Theory of Harmonic Oscillators', *Nuclear Physics*, 18, p. 697 (1960); 23, p. 177 (1961) in collaboration with V. Bargmann; Moshinsky, M., 'Basis for irreducible representations of unitary groups and some applications', *J. Math. Phys.*, 4, p. 1128 (1963); 6, p. 682, p. 1540 (1965); 7, p. 691 (1966); 10, p. 455 (1969); Moshinsky, M., 'Canonical transformations and their representation in quantum mechanics'. Over twenty publications in *J. Math. Phys.* and *Annals of Physics* starting in 1970. Among the most relevant ones: *Ann. Phys.* (NY), 114, p. 243 (1978); 120, p. 402 (1979); 127, p. 458 (1980); (1986); Moshinsky, M., 'Collectivity and Geometry'. Over twenty *papers* dealing with collective models of the nucleus viewed from a group theoretical standpoint and appearing mainly in *J. Math. Phys.* Among the most relevant ones: *J. Math. Phys.*, 25, p. 1555, p. 1565, p. 2815 (1984). Moshinsky, M., 'Pseudoatoms and atoms in strong magnetic fields', *Ann. Phys.* (NY), 163, 1 (1985); Moshinsky, M., 'The Dirac oscillator', *J. Phys. A: Math Gen.*, 22, L817 (1989); Moshinsky, M., 'Art or Science: The symmetry Lie algebra for a Hamiltonian with accidental degeneracy', *Ann. Phys.*, 198, p. 103 (1990); Moshinsky, M., 'A relativistic cockroach nest', *Can. J. Phys.*, 72, p. 453 (1994); Moshinsky, M., 'Supermultiplets and relativistic problems', *J. Phys. A: Math. Gen.*, I. 29, p. 6027 (1996); II. 31, p. 6045 (1998); III. 31, pp. 10017-28 (1998); Moshinsky, M., 'Diffraction in time with dissipation', *J.*

*Phys. A. Math Gen.*, 34, p. 4217 (2001); Moshinsky, M., 'Matrix representation of the Sturm-Coulomb problem in a magnetic field and its implications for chaos', *Rev. Mex. Fis.*, 46, supplement 1, (2003); Moshinsky, M., 'The relativistic and quantum mechanical and applications to bottomonium', *J. Phys. A. Gen.*, 36, p. 2163 (2003).