

Project leader	Raduta Apolodor Aristotel
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Doctor since	1972
Scientific title	Professor doctor
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Institutional code in the Register of Potential Contractors	870
Project title in English	Topical research on nuclear structure, phase transitions and double beta decay. Acronim : TRNSPTDBD
Project title in Romanian	Cercetari moderne despre structura nucleara, tranzitii de faza si dezintegrarea beta dubla
Domain of proposal	Domain: PE Subdomain: PE2 Main Research Area: PE2_3 Secondary Research Area: PE2_1 Secondary Research Area (optional) PE2_14
Keywords	Keyword 1: spectroscopic properties Keyword 2: nuclear phase transitions Keyword 3: symmetry breaking and restoration Keyword 4: double beta decay and sum rule

Project duration	36 months		
Total funding requested	357142.86 EURO	2011	125 000 Lei
	1 500 000 Lei	2012	500 000 Lei
		2013	500 000 Lei
		2014	375 000 Lei

Summary:

Within the extended version of the Coherent State Model we shall search for a set of particle-core interaction strengths for which the three components system, quadrupole bosons, octupole bosons and a set of particles, exhibits a chiral symmetry. The magnetic properties of such a system will be studied. For a composite system of particles moving in deformed orbits and interacting with a phenomenological core described by quadrupole bosons, we investigate the multibackbending phenomenon in yrast and nonyrast bands. We shall elaborate exactly solvable models for studying the phase transitions from one symmetry to another. For γ variable, a differential equation for the Mathieu function will be used. As for the variable β , this will be described by the solutions of a sextic oscillator potential plus a centrifugal term. Also we shall study the CSM ability to describe realistically the transitions $O(6) \rightarrow SU(5)$, $O(6) \rightarrow SU(3)$. $2\nu\beta\beta$ decay rates are calculated within a fully renormalized pnQRPA formalism with the gauge symmetry restored. The p-p interaction will be replaced by a dipole pairing force. One expects that the β^\pm strengths obey the Ikeda sum rule, which should be valid for the GT proton-neutron two body interaction, and moreover a realistic description of the available data is provided.

Foreign experience of the project leader

- 1) Total period of time employed abroad as a researcher or benefiting from scholarship or fellowships: 98 months
- 2) Details of periods spent working abroad as a researcher.

- 1) Helsinki University, 1968, 2 months, collaboration with Prof. Dr. P. O. Lipas, payed by contract.
- 2) Niels Bohr Institute, Copenhagen, 1973, 2 months, fellowship.
- 3) IUCN-Dubna, in the period 1970-1971, 18 months. I was researcher in the group of V. G. Soloviov, payed by contract.
- 4) Frankfurt/Main, Goethe University, 24 months (1975-1976), Humboldt Fellow, collaborating with Prof. Dr. R. M. Dreizler
- 5) Institut für Theoretische Physik, KfA Jülich, Germany, 1978, 2 months, collaboration with Prof. Dr. Amand Faessler.
- 6) Institut de Physique Theorique et Haute Energies, Orsay, 1979, 3 months: collaboration with Prof. Dr. Giu Do Dang, payed by CNRS- France.
- 7) Institut für Theoretische Physik der Universität, Tübingen, 1981, 1983, 1985, 1987, each year for 3 months, collaboration with Prof. Amand Faessler within the mutual agreement between Germany and Romania.
- 8) Institute of Theoretical Physics, Coimbra University, 1992, 1 month, collaboration with Prof. Jao da Providencia.
- 9) University of Napoli, 1988, 2001, 2003, 2005, each year for 3 months, collaboration with Prof. Dr. Nicola Lo Iudice. I was payed by INFN as a visiting professor. In 2005 I benefited of a grant Copernicus given by the European Community.
- 10) Institut für Theoretische Physik der Universität, Tübingen, 2002, for three months. I got the prize Stability Pact in South East Europe given by the Humboldt Foundation.
- 11) Consejo Superior de Investigacion Cientifica (CSIC), Madrid, 1999-2000, Sabatical for 9 months. This position was obtained through competition. During this visit I collaborated with Prof. Dr. E. Moya de Guerra.
- 12) CSIC, Madrid, 2 months, grant NATO for Science and Technology, 2002; collaboration with Prof. Dr. E. Moya de Guerra.

13) Institute of Physics and Astronomy, Rutgers University, 2003, 1 month, grant NATO for Science and Technology ;Collaboration with Prof.Dr. Larry Zamick.

14)Institut für Theoretische Physik der Universität, Tübingen, 2004-2009, each year for 3 months, payed by DFG grant; collaboration with Prof. Amand Faessler.

15)Complutense University, Madrid, 2008, 3 months Distinguished Professor, grant obtained through competition from the SantanderBank. In this period I collaborated with Prof. E. Moya de Guerra and Prof. Dr. Pedro Sarriguren.

16)Institut für Theoretische Physik der Universität, Tübingen, 3 months in the period 1.05-31.07.2011, payed from a DFG grant obtained through competition.