

# Report on

## Ministerial visit to Slovakia and Romania 01-08 April 2006

*By S. Mabizela, Department of Mathematics, Rhodes University and N. Chetty, School of Physics, University of KwaZulu-Natal*

### **Introduction**

We accompanied H. E. Derek Hanekom (Deputy Minister, Ministry of Science and Technology) and officials from the Department of Science and Technology, the National Research Foundation and embassy officials on a visit to Slovakia and Romania from 01 to 08 April 2006. The primary purpose of the visit was to commit South Africa to the bi-national agreement that will be signed with Slovakia in May this year and the one that was signed with Romania two years ago. A ministerial memorandum of understanding was signed with Romania during this visit to enhance the current relationship. Collaboration with these countries is an important entry point for South Africa to participate in the European Union Framework Programmes.

We were part of a technical team whose primary brief was to interact with scientists during the many technical visits that had been arranged, and to investigate possible areas of collaboration especially in the fields of Mathematics and Physics. Mr Johan Eksteen of the Meraka Institute has been assigned to report on the field of information and communication technology.

We wish to point out that our visits were brief and restricted to research facilities in the close vicinity of Bratislava and Bucharest. It is therefore not possible to give a definitive account of all research activities in Slovakia and Romania, and we were not in a position to make generalizations. This report is, therefore, an incomplete description of possible areas of collaboration for South African scientists. The views expressed here are based on our personal perceptions and do not necessarily reflect those of the South African government. The cooperation agreements that South Africa signs with other governments help create a framework for research exchanges and collaboration between South African researchers and those of the other country. The success of these agreements depends entirely on the individual researchers and research groups in both countries developing programmes and research projects that can fully exploit the benefits of these cooperation agreements.

Both Slovakia and Romania have a long history of excellence in scientific research. This success has been strongly driven and promoted by their Academies of Science over several decades. During the communist era, there was a strong emphasis on the theoretical sciences such as Mathematics and Theoretical Physics, and certain strategic endeavours such as nuclear science. Many scientists were trained in the former Soviet Union and have maintained close links with research facilities there, for example at Dubna.

Both countries have over recent times increased their investment in research and development and have sound policies based on peer review that ensure international standards of scholarship, safety and ethics. There is strong coupling with European programmes such as at CERN in Geneva. There is evidence of extensive international collaborations, especially with other European countries. The quality of outputs as adjudged by publications in internationally recognized journals and postgraduate student training is, generally speaking, impressive.

Both countries face the major challenges of

- Brain drain
- Translating scientific research into exploitable outputs that can impact more directly on commerce and industry and hence the economy.
- addressing social problems including water and sanitation.

### **Potential areas of co-operation (S=Slovakia, R=Romania)**

The following is an incomplete list of research areas that could be of mutual interest to South African scientists:

Renewable energy (S): Wind and hydro technologies are reasonably well advanced in these countries. South Africa could benefit from increasing research in these areas. South Africa has a growing strength in photovoltaic cell technology, and this is an area that our international counterparts could benefit from.

Nuclear Fusion and Plasma Physics (R): South Africa has a strong plasma physics community spread across several institutions in the country. There is no serious research activity in the field of nuclear fusion. Such work requires specialized research facilities which we are not in a position to construct currently because of a lack of critical mass. It is suggested that the plasma physics community in South Africa establish a research programme in nuclear fusion as an alternate source of energy, and that this may be done in collaboration with Romania.

Material Science and Solid State Physics: Both Slovakia and Romania have increased their investment in experimental equipment. The Institute of Physics in Kosice, Slovakia has many different experimental programmes in Material Science, such as low temperature physics, superconductivity, etc. The Institute for Materials Science in Romania impressed us greatly with the innovation in experimental equipment. Some of the research facilities were comparable to what might be found at some of the top world laboratories.

Seismology (R): This is not an area of significant interest in South Africa. However, there is potential for applications to the stability of our deep-level mine systems, and this should be explored.

GRID Computing (R): Romania has invested significantly in GRID computing and are active participants in the ALICE programme at CERN, Geneva. There is a similar group under Prof Jean Cleymans at the UCT who could be encouraged to collaborate.

Laser Science (S and R): South Africa has a National Laser Centre which maintains an excellent research facility and enhances research in laser science at partner institutions in the country. The carbon dioxide laser system, for example, has been the basis for industrial collaboration. The African Laser Centre has been set up to increase collaborations with African scientists. The research group at Stellenbosch under Dr Erich Rohwer has been building a femto second laser system which rivals the best in the world. The CSIR has identified the field of photonics as an important emerging research area. These topics are all of current research interest in both Slovakia and Romania. The National Laser Centre of South Africa is encouraged to explore closer ties with laser scientists in these countries for mutual benefit.

Accelerator science (S and R): Slovakia has recently built a 17MeV Cyclotron that is used for nuclear physics research as well as in the production of radio nuclear isotopes for cancer treatment. Our scientists based at the iThemba Labs are also working in this and other related fields. The research in this field in both countries is very advanced, and there are enormous benefits in working more closely. Slovakia will be building a new more highly energetic cyclotron facility which should be operational within the next two years. This opens new opportunities for research for South Africans, especially those working at iThemba.

Romania has a tandem van der Graaf accelerator that is used for studying nuclear physics reactions. The equivalent accelerator at iThemba Labs is not as powerful. South African nuclear experimentalists are encouraged to investigate possible collaborative research projects with their Romanian counterparts.

Space Science (R): There is advanced research in the building of satellites and detectors at the Institute for Space Research in Romania. Similar groups exist at Stellenbosch and the CSIR. South Africa has an interest in establishing a Space Research Institute in the near future. Collaborating with the Romania scientists in this domain will enhance our work and will give us access to the European Space Programme.

High energy physics (S and R): There are many theoretical physicists working in this field in Slovakia and Romania. Many of the experimentalists are collaborating on large research projects at the major European particle physics facilities, such as at CERN. This creates the opportunity for South Africans interested in this field of research to be involved in large European projects by establishing collaborations with researchers in Slovakia and Romania.

Theoretical Physics (S and R): This field of endeavour has traditionally been very strong in both Slovakia and Romania. South Africa is in the midst of launching the National Institute for Theoretical Physics (NITheP). Prof Hendrik Geyer from the University of Stellenbosch has been appointed acting director. There are excellent opportunities for theoretical physicists and mathematicians from these countries to be involved in many of the activities planned for the NITheP.

African Institute for Mathematical Sciences: Mathematicians and Physicists from both countries should be encouraged to participate in teaching programmes at AIMS which is located at Muizenberg near Cape Town. These programmes typically are for a few weeks. This will give the visiting scientists an opportunity to contribute in the African continent's effort to develop mathematical skills. This will also give the visitor an opportunity to interact with researchers in academic institutions in South Africa.

Quantum computing and cryptography: There are burgeoning groups in this field in Slovakia and South Africa (Prof Francesco Petruccione at the University of KwaZulu-Natal).

Experimental physics: South Africa needs to invest more significantly in experimental equipment. There is also a dire need for scientists in South Africa to become more innovative in building their own equipment, or in modifying existing equipment to address new research problems. Both Slovakia and Romania have similar difficulties in renewing aging experimental equipment. South Africa can learn enormously from their counterparts in these countries by being more involved in

innovation of experimental equipment. High quality workshop facilities staffed by well-trained technical staff are essential as can be seen in Romania, for example.

ICT: The areas of e-business, e-government, e-medicine, etc are receiving much attention, for example by the Institute for Informatics in Romania. These areas are extremely crucial for the future well-being of South Africa. A focused effort must be made to develop these fields more extensively in South Africa.

Bioinformatics: The South African Bioinformatics Institute stands to gain by building strong linkages with the Institute of Informatics in Romania where similar research programmes exist. A substantial exchange of visitors will enhance this important field of research activity in both countries.

Agriculture and Biotechnology: This vast field is of enormous interest to all countries concerned. South Africa has a vested interest in developing its biotechnology sector, and it will gain enormously by establishing research linkages with a number similar initiatives in both Slovakia and Romania.

Environment (R): The Danube Delta project in Romania has been designated an EU centre of excellence. There are important environmental topics that could be of enormous relevance to South Africa, for example soil erosion, maintenance of delicate wetlands, water conservation, etc. World-class expertise exists in Romania. It is useful for South Africans to investigate areas of mutual co-operation.

Motor vehicle production (S): Slovakia has the world's largest growing automobile manufacturing sector and assembly plants which provide a strong overlap with such industries in South Africa. Both countries need to be more involved in research in this manufacturing sector, for example in the use of lighter, more durable materials. Research collaborators involving academia and industry in both countries must be enhanced in this field.

Astronomy: In this area both Slovakia and Romania have excellent opportunities to collaborate with South African astronomers who have access to some of the world's largest observational facilities such as SALT, HESS, HARTRAO and the proposed SKA. The strong mathematical and theoretical training of scientists in these countries will complement very well the strong experimental/observational training of the South African scientists in this field.

Mathematics (S): Slovakia has a long and well established tradition of research in Mathematics. The main research areas of the Mathematics Institute of the Slovak Academy of Sciences are Topology, Algebra, Logic (many-valued, quantum), Real Function Theory, Measure & Integration, Combinatorics, Theoretical Computer Science, Mathematics of Fuzzy Systems, Probability and Statistics, Number Theory, Dynamical Systems, Graph Theory and Discrete Mathematics, and Complexity Theory. There are some South African researchers at UNISA (Susan van Aardt, Marietjie, and others) who are collaborating with some Slovak Mathematicians. The Mathematics Institute of the Slovak Academy of Sciences provides excellent research facilities. The Institute publishes several Mathematics journals of high international standing.

Mathematics (R): The Institute of Mathematics (Simion Stoilov Institute) of the Romanian Academy is recognized as a European Centre of Excellence. It has about 120 researchers in both Pure and Applied Mathematics. The institute offers Masters and PhD degree programmes. The

major areas of research are: Operator Theory, Functional Analysis, Mathematical Physics, Fluid Mechanics and Elasticity, Potential Theory, and Informatics.

The Institute runs the Mathematics Enrichment and Olympiad programmes. It is a fact of historical note that Romania hosted the first International Mathematics Olympiad in 1959. Since then, it has hosted it five times. Establishing cooperation arrangements with Romania for the training of our IMO team will very beneficial.

Image reconstruction from projections in computed tomography: In both Slovakia and Romania there is great interest in the problem of reconstructing an image from projections. In Slovakia, this problem arises in the context of computed tomography. In Romania, the same problem is considered in the problem of reconstruction of the fission products used in fuel rods. South African researchers working in these fields are encouraged to make contact with their counterparts in Slovakia and Romania.

### **Final Remarks**

For South Africans, there are many possibilities for research collaboration with researchers in Slovakia and Romania. South African scientists are encouraged to explore research possibilities in these countries that could be of mutual interest by getting directly in touch with their counterparts in these respective countries. This needs to be done well in advance of the call for proposals. It is important that funding be available at the pre-proposal stage to assist scientists to get together to develop joint proposals.

South Africa could possibly learn from the manner in which the Academies of Science in Slovakia and Romania have structured and how they been actively involved in promoting scientific development in their respective countries. The Academies are sufficiently resourced to drive research within the various institutes. The South African Academy of Science is not similarly structured, but could be playing a more important role in setting the research agenda in South Africa.

Slovakia has instituted a system of Agencies that are governed by Boards and whose primary brief it is to drive certain key focus areas at government level, such as nanotechnology, renewable energy, etc. This structure could be of use in the South African system of innovation.

Slovakia and Romania could possibly learn from South Africa's growing experience in positioning research as a basis for development in the country, and by involving industry more directly in funding research, for example via the THRIP programme, centres of excellence.

**Prof S. Mabizela**  
**Prof N. Chetty**  
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