Bernard M’Passi Mabiala: The Image of Capacity Building and Regional Integration in Central Africa

A profile on the physicist who impulses electronic structure methods and applications in Congo and in Central Africa.

Professor Bernard M’Passi Mabiala is a servant of science. He has sacrificed his career in order to give a face to Congolese physics. The physics school in Brazzaville, the capital of Congo, bears his signature. Several generations of African physicists have continuously benefited from the impetus he has given to computational condensed matter physics in Congo and the Central African sub-region.

From experimental physics to computational physics and renewable energies
At the end of September 1976, just after his scientific baccalaureate (entrance exam to university), Bernard M’Passi Mabiala took off for university studies in East Germany, precisely in Halle. Aware of the shortcomings in experimental training at secondary school level due to the lack of a suitable environment, poor equipment, and even the lack of appropriate practical laboratories in high schools and colleges, he opted for a master’s degree (“Diplom” in Germany at the time) in experimental physics, despite his excellent theoretical predispositions.
Subsequently, he trained in experimental physics, and then more specifically in solid state physics with a specialization in surfaces and interfaces, at the Martin Luther University in Halle-Wittenberg, Germany. In his dissertation, he studied the ion sputtering of Cu-Ni alloys using Auger spectroscopy. Upon completing his training, he returned to Congo to assume a teaching assistant position at the Marien Ngouabi University in Brazzaville, a common practice at the time.

In fact, due to a lack of managers and the development needs of their countries, young African graduates, particularly those from Eastern European countries at the time of the two blocs, were obliged to return to their home countries following training in order to pass on the knowledge they had acquired to their communities. Despite returning home, he had not lost sight of his intention to pursue a PhD thesis in the near future. A visionary and builder at heart, he had clearly understood that one needs to complete the research cycle in order to establish a line of Congolese physicists capable of carrying out research and producing useful knowledge for science-based societal transformation. It was a distant dream, but not impossible. A heavy calling, but a necessary one for a country like Congo, which is in full development.

During his tenure as an assistant in the physics department in Brazzaville, a French university aid worker, impressed by his predispositions, skills, and passion for the scientific development of his country, recommended him for a PhD program in France. This is how Bernard M’Passi Mabiala journeyed to Strasbourg, France, to continue his PhD studies through a sandwich program financed by the French Cooperation. Having already possessed an experimental background, he aspired to delve into the intricacies of matter and comprehend the first principles that govern physical phenomena. Consequently, he also studied theory during his doctoral program, focusing specifically on Density Functional Theory (DFT), which he used to examine the relaxation and magnetism of transition metal surfaces and interfaces. In 1996, he successfully obtained his PhD and returned to Congo.

In 1998, the Nobel Prize was awarded to Walter Kohn “for his development of the density-functional theory,” aligning remarkably with Dr. M’Passi Mabiala’s academic pursuits. (The Prize was also awarded that year to John A. Pople for “for his development of computational methods in quantum chemistry.”) Upon his return to Congo, he became an Associate of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, where he collaborated remotely with other DFT experts such as Dr. Salvador Meza Aguilar from Mexico, Dr. Alberto Debernardi from Italy, Dr. Claude Demangeat from France, and Professor Richard Martin from the USA. This collaborative effort effectively opened Congo to a network of international specialists in the field.

As a participant of the African Clean Energy Research Alliance (ACERA) network — which comprises the University of Leeds in the United Kingdom, the Dar es Salaam Institute of Technology in Tanzania, Makerere University in Uganda, and Marien Ngouabi University in Congo with financial support from the Royal Society — his original theoretical research activities have evolved under his leadership. He has expanded his activities to include experimental physics, with a particular emphasis on renewable energies. Furthermore, he has initiated and coordinated master’s and PhD training programs in the fields of materials science and energy. Within the Institut de la Recherche en Sciences Naturelles et Exactes (IRSEN), he helped establish research units in nanoscience and nanotechnologies, as well as in materials and energies.

Beyond Congo, sub-regional integration and the founding of CEPAMOQ

Professor M’Passi Mabiala has undoubtedly made major contributions to the sub-regional integration of physicists in Central Africa. Noteworthy among these efforts was the hosting of two significant events in Brazzaville: an installment of the Regional African School for Electronic Structure Methods and Applications (RASESMA) and the second edition of Central African School for Electronic Structure Methods and Applications (CASESMA) in April 2023.
Another notable example of Professor M’Passi Mabiala’s contributions include the co-founding of a center of excellence in physics in Central Africa. During his tenure at ICTP, where he was the first regular associate and then senior Congolese, he met Professor Moise Kwato from Cameroon. Together, they established the Centre for Atomic Molecular Physics and Quantum Optics (CEPAMOQ) in Douala, Cameroon. CEPAMOQ has effectively trained many young physicists from Congo, Cameroon, Chad, Central African Republic, Gabon, and beyond.

The Group of Numerical Simulations in Magnetism and Catalysis in Brazzaville
In the same vein, Professor M’Passi Mabiala established the Group of Numerical Simulations in Magnetism and Catalysis, in which the first local Congolese completed their PhD theses, thereby giving impetus to doctoral training in computational condensed matter physics in collaboration with CEPAMOQ and ICTP through the sandwich program (STEP-Program). The laboratory’s research interests include catalysis, magnetism, and 2D materials. The techniques applied include static DFT calculations, theoretical spectroscopy, and molecular dynamics in order to take account of temperature and approximate operando conditions and experimental observations.

The Brazzaville School of Physics has already achieved a compelling scientific output, which opens doors to computing resources, as is the case with supercomputers in South Africa and Italy. Professor M’Passi Mabiala remains optimistic about the possibility of hosting a supercomputer in Brazzaville.

“In the [foreseeable future], and within a well-thought-out framework, it’s possible. Also, we need to count on collaboration, because even developed countries don’t have all the equipment,” he says.

**Outlook**
Today, Professor M’Passi Mabiala holds the position of General Director of Higher Education within the Ministry of Higher Education, Scientific Research, and Technological Innovation of Congo. Nevertheless, he continues to spare no effort. His aspiration is to establish a Congolese physics society in the near future. He believes that this endeavor will contribute enormously to bolstering research, federating efforts to organize science-focused events, and strengthening this pursuit.

He reflects upon a discussion that transpired several years ago among speakers at the 2006 APS March Meeting, specifically the Forum of International Physics (FIP) session on international physics, during which attendees discussed why it worked elsewhere and not in certain countries. All agreed that it was attributed to a problem of vision. Driven by this vision, Brazil began the trajectory to repatriate its scientists, channeling financial resources into research, and becoming a leader in several fields.

We hope that such a transformation will also occur in Congo. However, every society is bound by its own realities and pace, but Congo possesses a great visionary in Professor M’Passi Mabiala. We can look forward to a bright future, not only for Congo but for the entirety of Africa.