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MENTORING AFRICAN RESEARCH IN MATHEMATICS

END OF YEAR 2 REPORT

Any photos of the partnership would be welcomed for use by the LMS and IMU CDC for their publicity materials. Please send these to Katy Henderson (marm@lms.ac.uk)

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<p>European Mentor information</p> <p>University and Department: Postal Address: Lead Contact name: Lead Contact email: Lead Contact telephone number:</p>	<p>Université de Bordeaux, Institut de Mathématiques 351 Cours de la Libération, 33405, Talence, France Professor Alain Yger yger@math.u-bordeaux.fr (33) 5 40 00 69 45</p>
<p>Review of second year of partnership <i>Please comment on:</i></p> <ol style="list-style-type: none"> Any visits made in the second year: a) the aims of the visits; b) activities undertaken as part of the visits; c) objectives achieved by the visits. <p>A. During the second year, research stays of two former Master 2 students from the African Partner Institution (both involved since this year in a PHD program in Africa) have been entirely supported by the MARM contract (travel + lodging + expenses for a 3 weeks - 1 month term).</p> <p>Additional support for research stays of two doctoral students with IMU grants (for finalisations of their thesis) from the African Partner Institution has been provided by the MARM contract under the form of participation to the lodging (in the European Institution) during a 3 monthes term.</p>	

B. The activities undertaken as part of the two **research stays of former Master 2 students** from the African Partner Organization where the following :

B1. Winnie Ossete, who started in February 2016 the preparation of a thesis with a grant from the Simons Foundation (NGA) with title «*Calcul «Max-Plus», Variété «tropicale» et fonction de Ronkin*» (co-directors S. Sambou, D.N. Diatta, A. Yger, Université de Ziguinchor, Sénégal) came to Bordeaux for a research stay from February 27 till March 20 (2016) in order to collect all necessary elements necessary to start the preparation of her PHD thesis. A publication issued from W. Ossete's work during the first year of her thesis (since it started in February 2016) is about to be submitted ; her research stay in February-March 2016 was the starting point for the preparation of both her thesis and its first companion publication. The subject of the thesis is enclosed in the annexed documents.

B2. The second Master 2 student who came from the African Partner Institution to the European Institution (Bordeaux) for a 3 weeks research stay from September 23 till October 14 (2016) was **M. Bossoto**, a former Master 2 student in University Marien Nguabi during the Academic year 2014-2015. This student has been selected since his visit in Bordeaux for the preparation of a PHD thesis at the Pan African University PAUSTI (Kenya). The title of the thesis (which arose from the research stay in Bordeaux) is «*Amibes, Coamibes, Filtrage 2D*» (enclosed in the annexed documents to this report) ; it combines Mathematics and Image Processing. The research stay of the student in Bordeaux was an intensive stay in Differential and Complex Geometry, with an insight towards such questions related to Digital Imaging (according to the direction of the thesis).

B3. The two PHD students who came to the European Institution from the African Partner institution in order to finalize their PHD thesis (IMU grants, with additional MARM support) where **Servais Gatsé** (a PHD student of Professor Okassa in Brazzaville) and **Olivier Mabilia Mikanou** (a PHD student of Professor B. Bossoto in Brazzaville). The reasearch stay of these two students in Bordeaux was an intensive stay in Differential and Symplectic Geometry under the supervision of Professor Yger. The subject of these two thesis were respectively «*Structures de Lie-Rinehart et cohomologie de Poisson sur la variété des points proches*» (Mabilia) and «*Theorème de Darboux pour les variétés localement conformément symplectiques*». The defense of Mabilia's thesis was scheduled in Brazzaville in December, that of S. Gatsé's should take place in this term.

C. The main goal of these four research stays was, concerning the two former Master 2 students, to provide them with all facilities (access to documentation, intensive series of lectures and mathematical discussions, participation to the scientific life of the Institute of Mathematics in Bordeaux) in order to be prepared to jump from their Master 2 formation in Brazzaville (completed by the Master 2 course dispensed in Brazzaville by Professor Yger during the first year of the contract) to the starting of a PHD program . Concerning the PHD students who were in the finalization process of their PHD thesis in Brazzaville, the goal was to enlarge their scientific background, indicate to them potential future research directions, settle scientific relations for further collaborations of exchanges. These objectives have been fulfilled.

2. *Any other activities undertaken during the year: a) the purpose of these activities; b) the objectives achieve by these activities.*

An important part of the activity during the second year has been devoted to **documentation**. Between the BMI (library of the Institute of Mathematics), with responsible **Cyril Mauvillain** , and the University Marien Nguabi (through the active action of Professor Bossoto), several operations have been conducted :

- the program which consisted from the first year in creating a reasonable scientific library fond in

Brazzaville (in accordance with the major themes of mathematical research there) was carried on. About 25 books (see the list in annex) are now at the disposal of students in mathematics (more especially in differential and Riemannian Geometry as well as in commutative algebra, which were the major scientific themes beyond the MARM contract) .

- Additionally, transit of periodicals (or even collections or series of books) from the BMI in Bordeaux towards the Department of Mathematics in Marien Ngouabi University have been supervised by Cyril Mauvillain in Bordeaux and Professor B. Bossoto in Brazzaville.

- The scientific documentation links such as the **bordeautheque** service have been highly activated between the African and European institution.

Review of the partnership as a whole

1. *Please comment on the progress of the partnership across the two years of the project. Please include any significant achievements made during the course of the project; any particular difficulties met and how these were addressed; any lasting changes that were achieved for the department; any other comments.*

One of the major objectives of the partnership from its starting point was to enlarge the range of opportunities for young researchers trained at Brazzaville to enter actual domains of mathematical research : intensive mathematical training, access to documentation, possibility to participate to EMA or CIMPA schools, diversification of mathematical thematics besides differential geometry, together with consolidation of the existent ones, etc. A significant achievement of the partnership with respect to this objective is precisely the fact that two former Master 2 students (attending the graduate course dispensed by the European mentor at the beginning of the first year) are now involved in PHD programs respectively in Sénégal (doctoral grant of the Simons Foundation) and in Kenya (PAUSTI doctoral grant).

Among the difficulties met when the partnership started, lack of access to documentation in the African partner institution was certainly a quite serious one ; taking this into account, another key objective of the partnership has been precisely to facilitate such access ; such an objective has been partially fulfilled : purchase of specialized scientific books (according to the mathematical thematics developed in the African partner institution), initiation of formal relations at the level of exchange of documentation between University Marien Ngouabi in Brazzaville and the documentation network to which the European Institution (Institut Mathématique de Bordeaux) is participating, are the most significant achievements with respect to this second objective.

Organizing long term (3 weeks-1 month) research stays of Master 2, Doctoral students or even confirmed researchers from the African Institution to the European one happened to be made difficult by lodging costs or administrative formalities (especially in France within the two years period where this partnership was carried on), which explains that it could be effectively carried on the basis of three such scientific stays each year (within the budget allowed by the partnership contract). Nevertheless, such difficulties could be overcome thanks to the help of some additional support (UMI, facilitation of the Simons Foundation, CNRS) and all operations conducted through the partnership according to such politics revealed to be successful.