Activity report - 2017 IMU-Simons Africa

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1-Activity report

1. ***Brief description of the research activities during my research visit:*** The main aim in our proposal research program submitted to the IMU-Simons African Fellowship Program Grants was to investigate some basic properties of new functional spaces in the context of hyperholomorphic functions.

2. ***Joint activities with my host:*** We have interacted and discussed some of our research works and projects with Prof. Irene Maria Sabadini who is one of the leading mathematicians, especially in the theory of slice hyperholomorphic functions and Clifford analysis. Attending some seminars organized by many research teams at the Dipartimento di Matematica del Politecnico di Milano was of some interests of me. We also have met Prof. K. Thirulogasanthar (Concordia University, Canada) and we have discussed some mathematics and possible applications of our obtained results in the slice hyperholomorphic analysis in mathematical physics.

3. ***Research in progress (as a result from the visit):*** In the original proposal we have envisaged to discuss the following points
   - Establish a prospective direct connection between the classical two dimensional Fock space and the slice hyperholomorphic one,
   - Segal-Bargmann transform in slice and Clifford Analysis.

During our stay in the Polimi, we have made some progress on these topics and has given rise to publication 3 and preprints 5 and 6 in the list below.

Published papers

1. Mehler's formulas for the univariate complex Hermite polynomials and applications. ***Math. Methods Appl. Sci,*** *2017.*
2. On concrete spectral properties of a twisted-Laplacian associated to a central extension of the real Heisenberg group. Joint work with A. El Fardi, A. Intissar. ***Adv. Math. Phys.*** 2017.
3. The slice hyperholomrophic Bergman space on Br: integral representation and asymptotic behavior. Joint work with A. El Kachkouri. ***Complex Analysis and Operator Theory. (12) 2018, no 5, 1351-1367.***
4. Analytic and arithmetic properties of the (Γ,χ)-automorphic reproducing kernel function and associated Hermite-Gauss series. To appear in the ***Ramanujan journal, 2018.*** DOI 10.1007/s11139-018-0032-9.Joint work with A. El Fardi, L. Imlal, M. Souid El Ainin.

Preprints

5 Generalized quaternionic Bargmann-Fock spaces and associated Segal-Bargmann transforms. Joint work with A. El Hamyani, Arxiv 1707.01674.

6 On Some analytic properties of slice poly-regular Hermite polynomials. Joint work with A. El Hamyani, Arxiv 1612.0809v4 (26 Mar 2018).

7 Non-trivial 1d and 2d integral transforms of Segal-Bargmann type. Joint work with A. Benahmadi, Arxiv 1707.06309v2.

2. Students and post-doctoral fellows advised: Aymane El Fardi (who defended recently -12 July 2018- his Ph.D Thesis in Rabat). Kamal Diki who spent a month (Mai 2017) in Polimi (He will defend his Ph.D. Thesis in Rabat by 11 October 2018) - Abdellatif El Kachkouri.

3. A summary statement of major outcome of research visit: We have finalized the papers 1, 2 and 4 as well as the preprint 6. We also proved mathematical results on the second Bargmann transform for hyper-holomorphic Bergman space (paper 3). We have also initiated many projects. Preliminary results are arranged as reprints.

4. Planned follow up activities and future implications: We envisage strong collaboration by developing different commune research projects, mentoring and exchanging Ph.D. students, etc. As example, my Ph.D. student K. Diki has obtained the prestigious grant "Marie Sklodowska-Curie fellow of the Istituto Nazionale di Alta Matematica" to prepare another Ph.D. thesis in Italy under the supervision of Prof. I. Sabadini.

Prof. Allal Ghanmi