Vector valued Orthogonal Polynomials and Multiplicity Free Induction: Deformations and Quantizations

A Data Management Plan created using DMPonline

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Project abstract:

The induction of a character of a compact symmetric subgroup K to its compact overgroup U is multiplicity free and as a consequence the harmonic analysis on the symmetric space U / K is well understood. Most notably is the reflection of the multiplicity freeness in the commutativity of the algebra of K - invariant differential operators on U / K , which ultimately realizes the zonal spherical functions as Heckman- Opdam polynomials. Along the same lines one can understand the harmonic analysis on a quantum symmetric pair, where U is replaced by a quantum group and K by a coideal subalgebra. In this setting the zonal spherical functions can be identified with Macdonald polynomials. The multiplicity free induction of the character of K to U is also available for more general irreducible representations of K . Under a mild extra condition these irreducible representations have been classified recently and in all cases the corresponding spherical functions can be described by families of multivariable vector valued orthogonal polynomials. These families come with a discrete parameter, the so called geometric root multiplicities. These facts naturally lead to the following two questions: can the vector valued orthogonal polynomials be understood as vector valued Heckman-Opdam polynomials and is there a multiplicity free representation theory for the quantum symmetric pairs that would ultimately lead to vector valued Macdonald polynomials?

In the classical setting we want to understand the vector valued orthogonal polynomials in an analytic theory where the parameter can be deformed continuously and where the families are related with so called shift operators. In the quantum setting we want to understand the quantization of the multiplicity free representation theory of symmetric spaces: which irreducible representations of the coideal subalgebra induce multiplicity free to the quantum group and can the corresponding spherical functions be described by vector valued orthogonal polynomials. These problems are of independent interest but they are also related on each level by q-deformations and specializations. Both theories should explain the growing class of examples that support their existence and we expect a wide range of applications and further cross fertilizations, for example for algorithmic aspects in explicit calculations of embeddings and intertwiners.

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Copyright information:

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General Information

Name applicant and project number

prof.dr. H.T. Koelink, dr. M.L.A. van Pruijssen
OCENW.M20.108

Name of data management support staff consulted during the preparation of this plan and date of consultation.

prof Andrew Levan, RDM Steward IMAPP, October 11, 2021.
Consulted "IMAPP Research Data Management Policy", see https://www.ru.nl/publish/pages/1019605/imapp_rdm_policy_1.pdf

1. What data will be collected or produced, and what existing data will be re-used?

1.1 Will you re-use existing data for this research?

If yes: explain which existing data you will re-use and under which terms of use.

- No

Not applicable

1.2 If new data will be produced: describe the data you expect your research will generate and the format and volumes to be collected or produced.

This project is theoretical research in pure mathematics and as such it is not data-driven research. In particular, on this project no data will be generated.

1.3. How much data storage will your project require in total?

- 0 – 10 GB

Not applicable. No data is involved in the project.

2. What metadata and documentation will accompany the data?

2.1 Indicate what documentation will accompany the data.

Not applicable.

2.2 Indicate which metadata will be provided to help others identify and discover the data.

Not applicable.

3. How will data and metadata be stored and backed up during the research?

3.1 Describe where the data and metadata will be stored and backed up during the project.

- Other (please specify)

Not applicable.
Note that in pure mathematics, and in particular in this field, all theoretical considerations, proofs and derivations are contained in the articles and preprints.

3.2 How will data security and protection of sensitive data be taken care of during the research?

- Not applicable (no sensitive data)

4. How will you handle issues regarding the processing of personal information and intellectual property rights and ownership?

4.1 Will you process and/or store personal data during your project?

If yes, how will compliance with legislation and (institutional) regulation on personal data be ensured?

- No

Not applicable

4.2 How will ownership of the data and intellectual property rights to the data be managed?

Not applicable

5. How and when will data be shared and preserved for the long term?

5.1 How will data be selected for long-term preservation?

- Other (please specify)

Not applicable

5.2 Are there any (legal, IP, privacy related, security related) reasons to restrict access to the data once made publicly available, to limit which data will be made publicly available, or to not make part of the data publicly available?

If yes, please explain.

- No

Not applicable

5.3 What data will be made available for re-use?

- Other (please specify)

Not applicable

5.4 When will the data be available for re-use, and for how long will the data be available?

- Data available as soon as article is published

Not applicable

5.5 In which repository will the data be archived and made available for re-use, and under which license?

Not applicable.

5.6 Describe your strategy for publishing the analysis software that will be generated in this project.

Not applicable.

6. Data management costs

6.1 What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

Not applicable, since this project does not involve data.