R E P O R T

on the competition for academic position "Associate Professor"

in the area of higher education 4.Natural Sciences, Mathematics and Informatics, professional field 4.5. Mathematics, scientific specialty "Equations of Mathematical Physics (Mathematical Modeling in the General theory of Relativity and Quantum Physics)"

for the needs of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, announced in SG, issue 82/27.09.2024

This report is prepared by **Prof. D.Sc. Ognyan Kounchev** from the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, as a member of the Scientific Jury on this procedure according to Order № 435/26.11.2024 of the Director of the Institute of Mathematics and Informatics.

Only one applicant has submitted documents for participation in the announced competition: Hamed Pejhan, **PhD**, who is currently at IMI-BAS.

I. General description of the presented documents

1. Information about the application

The documents presented by the applicant for the competition satisfy the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its application, and the Rules for the conditions and regulations for acquiring scientific degrees and occupying academic positions in the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences.

According to the presented list of publications, Hamed Pejhan applies in the current competition for the academic position "Associate Professor" with a list of 12 scientific papers all published in high-ranked journals, more precisely, 10 of them are published in Q1 journals, and 2 are in Q2 journals (by Scopus classification). A list of the applicant's citations is also presented, as well as all other required documents (official notes, certificates, references for participation in projects and other relevant evidence), supporting the applicant's achievements.

2. Information about the applicant

According to the submitted CV, the applicant Hamed Pejhan was born in 1983. His bachelor's degree in Physics is from Urmia University (Iran), and his Master's degree in Mathematical Physics, at Azad University (Tehran, Iran), 2010; Azad University is number 2 in the ranking of the top universities in Iran. He has held postdoc positions at Azad University (2015-2018), Zhejiang University of Technology, Hangzhou, China (2018-2021), Independent researcher (Azad University, 2021-2023), and postdoc at the International Center for Mathematical Sciences (IMI-BAS), since 2023-to present day.

As for the teaching activities, Hamed Pejhan has been a supervisor of a PhD student at Azad University who defended his dissertation in 2018; they have five joint publications.

3. General characteristic of the scientific work and achievements of the applicant

The research interests of Hamed Pejhan and his papers presented for the competition are devoted to resolving foundational challenges in Quantum Field Theory and quantum gravity within curved spacetimes. He has collaborated with very prominent scientists in theoretical physics, as Professor Jean-Pierre Gazeau from Université Paris Cité, Paris, France, and lately, with Prof. Ivan Todorov and his research group, in particular at the ICMS at IMI-BAS. One may say that the methods used in the applicant's research and the scientific results obtained by him represent an original contribution to science and show that Hamed Pejhan has an in-depth knowledge in the scientific field of the competition and characterize him as an established scientist in his field. At least 5 of the publications are joint with his PhD student, Surena Rahbardehghan. I accept as equal the participation of the applicant in all papers in which he is a co-author.

4. Brief analysis of the scientific and scientific-applied achievements of the applicant contained in the documents presented for the competition

The first area of research of HP is devoted to **Consistency with Wigner's Approach, where** usignWigner's principles and examining the (projective) unitary irreducible representations of the de Sitter group, HP and coauthors provide deeper insights into the nature of elementary systems within the global structure of dS spacetime; cf. Refs. [2,3,4,6,9,10,12] in the provided list.

The second area of HP addresses **Conceptual Challenges**, where key conceptual challenges in constructing elementary systems in dS spacetime are resolved, as transition from classical to quantum theories, understanding the physical content in the limit of vanishing curvature, and interpreting thermal phenomena from a quantum perspective; cf. Refs. [2,3,4,6,9,10,12] and, specifically, Ref. [7].

The third area of HP addresses **Physical Interpretation in Curved Spacetimes**, where the main concepts of energy, momentum, mass, and spin (available in flat Minkowski spacetime and the Poincaré group), are considered in alternative frameworks for understanding the physical nature of elementary systems in dS spacetime; see Ref. [2].

The fourth area is related to **Innovative Quantization Frameworks and Addressing Local Gauge Symmetry Challenges**. The main achievement incorporates the Krein-Gupta-Bleuler quantization method. See Refs. [2,3].

The fifth area considers **Foundational Insights into the Cosmological Constant.** The work provides a novel perspective on one of modern physics' most persistent problems, suggesting that the vacuum structure in dS spacetime might inherently encode a small, positive cosmological constant, which opens new pathways for reconciling Quantum Field Theory with cosmological observations. [See, specifically, Ref. [1] and also [5,8,11].

Completing the analysis of the scientific results in the papers submitted for the competition, I would like to note that they represent a novelty in science having direct applications in various fields of mathematics and theoretical physics.

According to the documents submitted by the applicant, Hamed Pejhan, has 21 citations (without self-citations), most of which are in renowned international scientific journals.

It can be concluded from the submitted documents and declarations that:

a) the scientific publications meet the minimal national requirements for "Associate Professor" as well as the additional requirements given in the Rules for the conditions and regulations for acquiring scientific degrees and occupying academic positions in the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, for occupying the academic position "Associate Professor" in the professional field of the competition;

b) the scientific publications submitted for the competition have not been used in previous applications for acquiring a scientific degree or occupying an academic position.

5. Critical remarks and recommendations

I have no significant remarks to the documentation presented for the competition. The documents and necessary references submitted by the applicant are prepared accurately.

I have no critical remarks on the applicant's scientific work. The review of the documents presented at the competition shows that Dr. Hamed Pejhan is working on wide range of problems which are of current interest. He shows a flexibility to learn new areas and approaches.

CONCLUSION

The materials submitted by Dr. Hamed Pejhan for the procedure demonstrate that he is satisfying the requirements of the Law Act for Development of the Academic Staff in the Republic of Bulgaria (LADASRB), the Statutes for application of LADASRB, the Statutes for the conditions and regulations for acquiring academic degrees and occupying academic posts in BAS, and the Statutes for the conditions and regulations for acquiring academic degrees and occupying academic posts in IMI-BAS, for occupying the academic post "Associate professor". There is no data for plagiarism. I assess very positively his long-time research and pedagogical activity and recommend with conviction to the honorable jury to propose to the Scientific Council of IMI-BAS to elect Dr. Hamed Pejhan as an "Associate professor" in the area of higher education 4. Natural Sciences, Mathematics and Informatics, professional area: 4.5 Mathematics, Scientific specialty "Equations of Mathematical Physics" (Mathematical Modeling in the General Theory of Relativity and Quantum Physics).

22.1.2025   Signature: