OPINION

on a competition for an academic position "associate professor" in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.5. Mathematics, scientific specialty "Geometry and Topology" (Homogeneous spaces and geometric theory of invariants) for the needs of IMI-BAS, announced in SG no. 65/02.08.2024 and on the website of IMI-BAS

The opinion was prepared by: Academician Stefan Petrov Ivanov - FMI at SU and IMI-BAN, professional direction 4.5 Mathematics, scientific specialty "Geometry and Topology" (Differential Geometry), in his capacity as a member of the scientific jury for the competition according to Order No. 347/1.10.2024 of the Director of IMI-BAS.

Only one candidate submitted documents for participation in the announced competition: Dr. Valdemar Vasilev Tsanov, researcher at the International Center for Mathematical Sciences, IMI-BAS.

1. General description of the presented materials

The documents submitted by the candidate in the competition correspond to and even exceed the requirements of the Law on the Acquisition of Scientific Degrees and Academic Positions and the Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at the IMI-BAS.

To participate in the competition, the candidate Dr. Valdemar Tsanov submitted a list of 10 titles in total, 6 publications are in journals with an impact factor as follows Q1-1, Q2-2, Q3-1, Q4-2, 1 referenced in WoS with a total impact factor 5.891, 2 are in papers of international conferences and a habilitation thesis "Homogeneous projective spaces and invariant theory" of the Ruhr University in Bochum, Germany. A list of 16 citations of the works on the competition is presented, the total number of citations being 30, as well as 3 other documents supporting the candidate's achievements.

2. Brief professional and biographical details of the applicant

The candidate Dr. Valdemar Tsanov was born on 16.12.1980 in Sofia, Bulgaria. He received his Bachelor's degree in Mathematics from the University of Sofia “St. Kl. Ohridski”, FMI, in 2004. In 2003 he received his Bachelor's degree in Mathematics from the University of Nantes, France. In 2006 he became a Master in Mathematics and Mathematical Physics of the University of Sofia, “St. Kl. Ohridski”, FMI.

In the period 2007-2011, he was a PhD student in mathematics at Queen's University, Canada, where he defended his doctoral thesis on the topic: "Embedding of flag manifolds and cohomology

components of modules" and received a PhD in mathematics at Queen's University, Canada, in 2011. In 2020 he obtained his habilitation at the Ruhr University in Bochum, Germany with his habilitation thesis "Homogeneous Projective Spaces and Invariant Theory".

During the period 2011-2022, he worked as a research fellow at a number of universities in Germany: the Ruhr University in Bochum, the University of Göttingen in Göttingen, the Jacobs University in Bremen, and from 2023 he became a researcher at the International Center for Mathematical Sciences, IMI-BAS, where he has been working ever since.

He was the leader of his own scientific project of the Geman DFG at the University of Göttingen, he was a member of 5 scientific projects of the Geman DFG at the Ruhr University in Bochum, the University of Göttingen in Göttingen, the Jacobs University in Bremen and the PICOM program with the Bulgarian NSF, the last two being ongoing.

3. General description of the candidate's scientific works and achievements

The scientific interests of Dr. Valdemar Tsanov are mainly in the field of the geometric theory of invariants, universal tensor categories and moduli of infinite-dimensional Lie algebras, three-dimensional geometry and knot theory, as well as applications in mathematical physics of quantum systems. The main topic of his research is the geometry of homogeneous complex projective spaces, the structure of their groups of symmetries, the theory of invariants related to subgroups of groups of symmetries.

These are difficult and relevant areas of modern mathematics and mathematical physics worldwide, where mathematicians such as A. Borel, D. Hilbert, D. Mumford, the Fields laureate W. Thurston and others worked.

The candidate has submitted 6 scientific publications, in Q1-1 in Q2-2 in Q3-1 in Q4-2 and I will mention the journals Int. Math. Res. Notices (IMRN) - 1, J. Phys. A: Math. Theor. -2, Manuscripta mathematica-1, etc.

No plagiarism has been proved in the scientific papers submitted to the competition.

Obviously, the presented scientific works significantly exceed the minimum national requirements (according to Article 2b, paragraphs 2 and 3 of the Law on Scientific Research) and respectively the additional requirements of IMI-BAS for holding the academic position "Associate Professor" in the scientific field and professional direction of the competition.

4. Analysis of the applicant's scientific and scientific-applied achievements contained in the materials for participation in the competition

In my opinion, Dr. Valdemar Tsanov's contributions to the research of geometric invariant theory, universal tensor categories and modules of infinite-dimensional Lie algebras, representation theory, algebraic geometry and quantum information theory, three-dimensional geometry and knot theory as well as applications in mathematical physics of quantum systems are indisputable.

Suffice it to mention that when considering the action of a connected semisimple complex subgroup of a simply connected semisimple complex group G on the flag manifold G/B, a B-Borel subgroup of G, an explicit closed formula for the submanifold of unstable points is derived depending on the linearization of this action by homogeneous linear bundles, as well as the resulting formula for the dimension of this manifold by proving that linear bundles whose unstable submanifold has co-dimension at least p form a rational polyhedral convex cone. Applications of this result are also found in the context of the Geometric Theory of Invariants.

It is also worth noting that all equivariantly embedded homogeneous projective varieties over an algebraically closed field of characteristic 0 with rank-function (the minimum number of sums of vectors of the affine cone defining an arbitrary vector) lower semi-continuous are classified. The main result given here is a list of all irreducible representations of reductive groups with rank-function lower semi-continuous.

The quality of his work is evidenced by the corresponding high numerical indicators: Dr. Valdemar Tsanov has submitted a habilitation thesis and 9 publications for the competition and in all articles he has documented a significant contribution. I will note the publications in **Int. Math. Res. Notices (IMRN)** - 1, **J. Math. Phys. A: Math. Theor**. -2, **Manuscripta mathematica**-1 as the cumulative impact factor of the competition publications is 5.891. There are also 16 citations listed for these papers, bringing the total number of citations for the candidate to 30. I should note that the total text of these 9 publications amounts to 280 pages. His results have been presented at about 50 international conferences and seminars in the country and around the world.

5. **Teaching activities**

The candidate, Dr. Valdemar Tsanov has a very rich teaching activity in his home country, Sofia University-FMI and around the world, the Ruhr University in Bochum, the University of Göttingen in Göttingen, Queen's University, Canada, where he has given lectures and seminars on Complex Analysis, Real Analysis, Linear Algebra and Analytical Geometry, ODE, Harmonic Analysis, etc. Together with Peter Heinzner he supervised a successful PhD student at the Ruhr University Bochum.

6. Conclusion about the application

Having read the materials and scientific works submitted in the competition and based on the analysis of their significance and scientific and applied contributions contained therein, **I confirm** that the scientific achievements meet the requirements of the Law on Research and Development, the Regulations for its application and the relevant Regulations of IMR-BAS for the appointment of Dr. Valdemar Tsanov to the academic position of Associate Professor in the professional field and scientific area of the competition. In particular, the candidate satisfies the minimum national requirements and the additional requirements of BAS in the professional field and no plagiarism has been found in the scientific works submitted for the competition.

I give my **positive** assessment of the application.

II. General Conclusion

Based on the above, **I recommend** the scientific jury to propose to the competent authority for the selection of the IMI-BAS to elect Dr. Valdemar Vasilev Tsanov to occupy the academic position of "Associate professor" in professional direction 4.5. Mathematics (Homogeneous spaces and geometric theory of invariants).

6.11.2024 г. Prepared the opinion: .....

(acad. Stefan Ivanov)