

Review

for the selection process for the academic position of Associate Professor in the professional field 4.1 Physical Sciences (String Theory and High Energy Physics)

for the needs of St. Kliment Ohridski University of Sofia, Faculty of Physics

announced in State Gazette no. 63 on 30.07.2021

This review was prepared by: **Acad. Nikolay Vitanov Vitanov** from St. Kliment Ohridski University of Sofia, in his capacity as a member of the scientific jury for the selection process for the academic position of Associate Professor in the professional field 4.1 Physical Sciences (String Theory and High Energy Physics) according to Order № RD-38-488 / 01.10.2021 of the Rector of Sofia University.

Only one candidate has submitted an application for the announced position: **Head Assistant Professor Dr. Tsvetan Ivanov Vetsov** from the Faculty of Physics of St. Kliment Ohridski University of Sofia.

I. GENERAL DESCRIPTION OF THE SUBMITTED MATERIALS

1. Details of the application

The documents submitted for the competition by the candidate comply with the requirements of ZRASRB, PPZRASRB and the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at St. Kliment Ohridski University of Sofia (PURPNSZADSU). For participation in the competition the candidate Dr. Tsvetan Vetsov presented a list of 23 publications in international peer-reviewed and indexed journals with impact factor and/or impact rank. 5 of these publications have been used in the candidate's doctoral dissertation and in his application for head assistant professor. 12 publications are in Q1 journals, 1 is in Q2, 2 are in Q3, 4 are in Q4, 3 publications have SJR numbers and there is one chapter in a book. A letter from Prof. Radoslav Rashkov was also presented, confirming the scientific contributions of the candidate. More than 10 other documents were presented (in the form of official notes and certificates from the employer, project manager, financing organization or contracting authority, etc.), supporting the achievements of the candidate.

Notes and comment on the documents: no.

2. Details of the candidate

Tsvetan Vetsov was born in 1986 in Razlog. He graduated from the Faculty of Physics at Sofia University in 2011 with a master's degree in Theoretical and Mathematical Physics. In 2015 he successfully defended a doctoral thesis on "String approach to calibration theories" with supervisor Prof. Radoslav Rashkov. In 2015 he won a contest and started working as a head assistant professor in the Department of Theoretical Physics at the Faculty of Physics of Sofia

University. He has participated in 10 projects (7 as a team member and 3 as a leader), funded by NSF and Sofia University.

3. General characteristics of the scientific works and achievements of the candidate

The main contributions of Dr. Tsvetan Vetsov are in the string theory and gravity. They can be grouped into several main groups: information geometry and Fisher metrics, entropy of entanglement, thermodynamics of black holes, dynamics of string solutions, supergravity, and relativistic images of accretion disks. In the presented works the co-authors are arranged in alphabetical order. Therefore, I judge the (significant) personal contribution of the candidate from the letter from Prof. Radoslav Rashkov and talks with his co-authors.

As a summary of the review, the following can be concluded:

- The scientific works fully meet the minimum national requirements (under Art. 2b, para. 2 and 3 of ZRASRB) and respectively the additional requirements of St. Kliment Ohridski University of Sofia for holding the academic position of Associate Professor in the professional field 4.1 Physical Sciences.
- The scientific papers submitted by the candidate from number 6 to number 23 do not repeat those from previous procedures for acquiring a scientific degree and an academic position.
- There is no legally proven plagiarism in the scientific papers submitted for the contest.

As a very positive general impression, I can emphasize that even though he is only 35 years old, the candidate has interests and achievements in areas outside the narrow field of his dissertation and some of his publications are without his supervisor, including ones in which he is the sole author. This speaks of ambition, ability, and independence.

4. Characteristics and evaluation of the candidate's teaching activity

Since entering the Department of Theoretical Physics in 2015, the candidate has been fulfilling full teaching load. In addition to being teaching assistant in several disciplines in Mathematical Methods in Physics and Theoretical Physics, he has given also lectures in such disciplines, as well as special courses. The teaching activity of the candidate satisfies and exceeds the minimum requirements of the Faculty of Physics for the position of Associate Professor. My assessment of the teaching and pedagogical activity of the candidate as his colleague and as head of the Department of Theoretical Physics is excellent. In addition, Dr. Vetsov was the supervisor of three successfully defended bachelor students at the Faculty of Physics.

5. Content analysis of the scientific and applied-scientific achievements of the candidate contained in the materials for participation in the contest

The candidate's contributions to the field, which he defines as Information Geometry and Fisher's Metrics, are the most numerous ones. These include 4-dimensional black holes in modified gravity with higher derivatives, 3-dimensional holographic black holes, bosonic strings

in a plane-parallel space-time background, chains of Pais-Uhlenbeg oscillators with higher derivatives, and holographic systems with nonrelativistic Schrödinger symmetry. The main tool used by the candidate are the algebraic and differential invariants of the curvature of the Fisher metric. The second largest group of problems studies the entropy of entanglement applied to bosonic strings in a plane-parallel space-time background, chains of Pais-Uhlenbeg oscillators with higher derivatives, condensed systems of bosons and fermions, and dissipative quantum systems. The third area covers problems with black hole thermodynamics, including a 4-dimensional static black hole of Desser-Sarioglu-Tekin (DST) type with dark matter and a 3-dimensional rotating hole of Lifshitz in the theory of massive gravity. Here it is worth noting that the method of quasi-local energies of Brown and York made it possible to obtain the mass of the DST black hole – an important result because for a long time the mass and thermodynamics of this black hole have not been fully studied. Contributions to the dynamics of string solutions include three types of string solutions: spikes, magnons, and rod-shaped strings. The candidate has also contributed to two other areas: solutions in supergravity with non-Abelian T-duality and relativistic images of accretion disks around dark compact objects, including black holes and bare singularities.

The nature of the candidate's scientific contributions can be defined as: development and application of new methods and enrichment of existing knowledge.

According to Web of Science, Dr. Vetsov has 91 independent citations (excluding his self-citations but including self-citations from his co-authors), and his H-index is 6. According to Scopus, he has 60 independent citations, and his H-index is 5. His five most cited publications are numbered 7, 9, 10, 15 and 17, the most cited one being number 17 with 23 citations. All of them are publications from the list with which he applied for the contest. These scientometric data exceed the elevated requirements of the Faculty of Physics.

6. Critical remarks and recommendations

None.

7. Personal impressions of the candidate

I know Dr. Vetsov since his appointment at the Department of Theoretical Physics. During all this time he established himself as a capable and responsible teacher, open to his colleagues and became one of the favorite teachers of the students.

8. Conclusion on the application

After getting acquainted with the materials and scientific works presented in the contest and on the basis of the analysis of their significance and the scientific and applied-scientific contributions contained in them, I confirm that the scientific achievements meet the requirements of ZRASRB, the Regulations for its application and the respective Regulations of St. Kliment Ohridski University of Sofia for the academic position Associate Professor in the

professional field 4.1 Physical Sciences. In particular, the candidate satisfies the minimum national requirements in this professional field and no plagiarism has been established in the scientific papers submitted for the selection process. I give my **positive assessment** of the candidacy.

II. OVERALL CONCLUSION

Based on the above, I **recommend** the scientific jury to propose to the Faculty Council of the Faculty of Physics at St. Kliment Ohridski University of Sofia to elect Dr. Tsvetan Ivanov Vetsov to take the academic position of Associate Professor in the professional field 4.1. Physical sciences (String theory and high energy physics).

22.11.2021

Academician Nikolay V. Vitanov