

OPINION

on a competition for academic credibility

Associate Professor

in the professional field 4.5 Mathematics, specialty Mathematical Methods in Physics (Algebraic and Statistical Methods),

for the needs of Institute of Mathematics and Informatics, Bulgarian Academy of Sciences,

announced in Government Bulletin no. 89 of 16/10/2020

This opinion is prepared by: Prof. Radoslav Christov Rashkov, Dr. Habil,

Sofia University Faculty of Science, as a member of the scientific jury of the competition:

4.5 Mathematics, specialty Mathematical Methods in Physics (Algebraic and Statistical Methods), according to Order No. 216/14.12.2020 of the Director of Institute of Mathematics and Informatics.

Only one candidate has submitted documents for participation in the announced competition:

Chief Assistant Dr. Veselin Georgiev Filev, Institute of Mathematics and Informatics, Bulgarian Academy of Sciences (BAS).

I. General description of the materials presented

1. Details of the application materials

- The documents submitted by the applicant according to the competition comply with the requirements of ZRASRB, RAPRRRB and the Regulations on the conditions and procedure for acquiring academic degrees and occupying academic positions at Institute of Mathematics and Informatics (IMI), Bulgarian Academy of Sciences.

- To participate in the competition, the candidate Veselin Georgiev Filev presented a list of 7 publications (6 in Q1, 1 in Scopus). The total number of 38 with authorship titles of scientific publications in the most prestigious Journals are distributed as follows: 31 in quartill Q1, 1 in Q2, 1 in Q4 and 4 in proceedings of international conferences. Additional 18 documents (in the form of notes and certificates from an employer, project manager, project sponsor or sponsor, references and reviews, awards and other relevant evidence) supporting the applicant's achievements were also presented.

- Additional remarks and comments: All documents meet the requirement for the competition, including ZRASRB and requirements of IMI, BAS.

2. Details of the applicant

Short professional and biographical details for the applicant.

Education: *Veselin Filev* started his University education as a student in Faculty of Physics of Sofia University. There he obtained his Bachelor and Master degrees. *Veselin Filev's* Bachelor thesis is „AdS/CFT Correspondence in String Theory“. His Master thesis is entitled „Semiclassical analysis of rotating strings in Pilch-Warner background“, subsequently published in Physical Review D.

Doctoral Degree: Doctoral degree of *Veselin Filev* has been obtained from University of Southern California, Los Angeles, USA. Under the supervision of prof. C. Johnson, in the period 2003-2008, *Veselin* has published 8 papers and defended PhD thesis „Aspects of The Holographic Studies of Flavourdynamics“.

Postdoctoral experience: From 2008 to 2010 Dr. *Veselin Filev* has been postdoc in one of the prestigious Institutes in the area – Dublin Institute for Advanced Studies, Dublin, Ireland. Since then he has long term fruitful collaboration with Prof. Denjoe O'Connor.

In the period 2010-2012 *Veselin* has been specializing in Max Plank Institute, Munich, Germany. After this specialization he returns to the Dublin Institute for Advanced Studies, Dublin, Ireland 4 more years, until 2016.

From 2017 until now Dr. *Veselin Filev* is appointed in Institute of Mathematics and Informatics of Bulgarian Academy of Sciences. Dr. *Filev* is also teaching in American University in Bulgaria.

3. General characteristics of the applicant's scientific work and achievements

Dr. *Veselin Filev's* scientific subject is in one of the most up-to-date areas of modern theoretical and mathematical physics, namely, important problems of String theory, holographic correspondence, Gravity in space-times with more than the standard four dimensions, Matrix models etc. As a motivation for this type of exploration is drawn from fundamental questions in modern high energy physics - the Grand Unification theories in the context of Kaluza-Klein compactifications, string theory which is consistently defined in space-times with more than 4 dimensions, as well as closely related problems associated with mirror symmetry, matrix models, integrable systems etc. If one has to classify thematically the problems Dr. *Veselin Filev's* research is focused on, these are:

i) solutions for and properties of gauge theories with fields transforming in adjoint and fundamental representations at strong coupling in the context of holographic correspondence between supersymmetric Yang-Mills theory and supergravity in (asymptotically) anti-de Sitter spaces (AdS/CFT correspondence).

ii) investigation of thermodynamical characteristics and properties of gauge theories in holographic models. These considerations include obtaining and studying conserved charges, phase transitions etc.

iii) computer simulations of matrix models and calculation of microscopic characteristics of various holographic models.

Analyzing the materials presented in this competition, I can reasonably and definitely state that:

a) the scientific work done by Dr. Filev exceeds by far the minimum national requirements (under Art. 2b, par. 2 and 3 of ZRARB) and accordingly, the requirements of Institute of Mathematics and Informatics, BAS) for the academic position of Associate Professor in the scientific field and the professional direction of the competition;

b) the scientific papers submitted by the applicant do not repeat those of previous procedures for the acquisition of a scientific title and academic position;

c) there is no proven plagiarism in the scientific works presented at the competition.

4. Characterization and evaluation of the applicant's teaching activity

I would summarize V.Filev's teaching activity and experience as follows:

a) he has given seminars and labs during his PhD study in University of Southern California, Los Angeles, USA;

b) Veselin is teaching courses in American University in Bulgaria (in English), concretely on Finite Math, Statistics and Mechanics and Thermodynamics.

In view of my contacts with the applicant for many years, I commend the quality of teaching and activity as high as possible.

5. Substantive analysis of the scientific and applied scientific achievements of the candidate contained in the materials for participation in the competition

To give a short description of the achievements, I will briefly give an idea of the major problems in the area. The effective background geometry in AdS/CFT correspondence is obtained by inserting huge number of coincident D-branes (subspaces on which string with Dirichlet boundary conditions ends), which deforms the flat space into a curved one. All the fields in this construction transform under the adjoint representation. If one introduces another D-brane system, fields produced by strings ending on different intersecting D-branes transform under fundamental representation. Modeling in this way real theories, for instance Quantum Chromodynamics (QCD), is one of the challenging problems in the contemporary theoretical and mathematical physics.

Without going into a detailed description of the scientific contributions of Dr. Veselin Filev, I would make comments focusing on just a few papers:

- the first and seventh papers in list of papers are devoted to investigation of Yang-Mills theory with 4 supersymmetries in the presence of Kalb-Ramond field (antisymmetric second rank tensor).

Concretely, in the seventh paper the system is modeled by introduction of a specific system of D-branes, namely D3/D7 and D3/D5 brane systems. Detailed qualitative and quantitative analysis is presented including backreaction of the geometry and chiral symmetry, responsible for the magnetic catalysis. The most valuable contributions are: construction of a novel spacetime, accounting for backreaction of the geometry to D7-branes; non-commutativity of the field theory part transforming under the adjoint representation; existence of domain wall and phase transition point in D3/D5 system, the critical exponents of the system are also found.

- a series of two papers, the second and fourth ones, is focused on matrix model description of holographic models, including the so called membrane paradigm and BMN limit (theories in plane wave geometries). Matrix models are supposed to describe non-perturbative sectors of the theory. The focus is on the Berkooz- Douglas matrix model, dual to D0/D4 brane system. For the later system, the computer simulations test is the first direct test of AdS/CFT correspondence with completely broken supersymmetry and in the presence of fundamental fields. In addition, fundamental condensate curve is found and studied, as well as the mass susceptibility of the problem is considered. All the results are in perfect agreement with AdS/CFT correspondence.

- the papers numbered three and five are devoted to computer simulations and testing holographic flavour dynamics. This papers are in coherence with previous systematic studies of AdS/CFT correspondence. They are focused again on the Berkooz- Douglas matrix model, addressing the mass susceptibility in details.

Scientific achievements of Dr. Filev, not only those submitted for this competition, have been well appreciated and are really impressive. They are far above national minimal levels required by law. These publications are accompanied with a number of talks at international conferences and workshops.

Dr. Veselin Filev states for this competition **12** independent citation (out of **813** in total). I expect the citations to rapidly grow with the time.

All these does not exhaust Dr. V. Filev achievements at all. It is impressive his involvement in collaborations with world-wide known scientists as Clifford Johnson, Denjoe O'Connor, Johanna Erdmenger and others.

6. Critical notes and recommendations

Essentially, I have no critical remarks about the candidate. Looking at the scientific record of Dr. Veselin Filev, I would expect in short term to see his thesis for obtaining scientific degree Doctor of

sciences, for which I give my recommendation.

7. Personal impressions for the applicant

I have known the candidate since his student's years. I have witnessed the growth of Veselin Filev as scientist from student, to PhD, postdoc and Chief assistant. Although his participation in national and international scientific projects has been vaguely mentioned in the documents, I can confirm his valuable contributions to the scientific groups.

Throughout this time, I have witnessed Veselin's dedication to mathematical physics and the science, with which he has linked his professional realization. I can say that the opinion for his highest level competence and professionalism are well deserved. As a person, I should say that Veselin is excellent colleague you can always rely on.

8. Conclusion on the application

Having become acquainted with the materials and scientific works presented in the competition and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, **I confirm** that the scientific achievements of the candidate meet the requirements of the ZRASRB, the Regulations for its implementation and the corresponding Regulations of the Institute of Mathematics and Informatics , BAS, for the academic position of Associate Professor in the scientific field and professional direction of the competition. In particular, the applicant not only meets the minimum national requirements in the professional field, but substantially exceeds them. The scientific works submitted for the competition have not been established.

I am convinced of my **positive assessment** of the application.

II. Overall Conclusion

Based on the above, I recommend to the Scientific Jury to propose to the Scientific Council of the Institute of Mathematics and Informatics , BAS, Assistant Professor **Dr. Veselin Georgiev Filev to be elected** for the academic position of "**Associate Professor**" in the professional field 4.5 Mathematics, specialty Mathematical Methods in Physics (Algebraic and Statistical Methods).

12.02.2021

Signature:

(Prof. Dr. Radoslav Rashkov)