

OPINION

**on a competition for academic credibility
Associate Professor
in the professional field 4.1 Physical Sciences,
for the needs of Sofia University "St. Kliment Ohridski"(Sofia University),
Faculty of Physics (FZF), announced in Government Bulletin no. 30 of 15/04/2022**

The opinion was prepared by: Prof. Radoslav Christov Rashkov, Dr. Habil,
Sofia University Faculty of Science, as a member of the scientific jury of the competition:
4.1. Physical Sciences (Theoretical and mathematical Physics) according to Order No. RD 38-260 /
27.05.2022 of the Rector of Sofia University.

Only one candidate has submitted documents for participation in the announced competition:
Chief Assistant Dr. Kalin Viliyanov Staykov, Faculty of Physics of **Sofia University "St. Kliment Ohridski"**(Sofia University).

I. General description of the materials presented

1. Details of the application

To participate in the competition, the applicant submitted a list of a total of 13 articles (out of 18) in international journals with a high impact factor, 11 of which are in the Q1, one in the Q2 and one in the Q3 quartile.

The attached documents contain a description of the main results of the scientific work of Ch. assistant Dr. Staykov published in 18 articles in renowned journals with an impact factor and 3 reports from conferences (two of which in publications with an impact rank). Observed independent citations are 380 and Hirsch factor $h=10$.

- 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 Sofia University "St. Kliment Ohridski "(PURPNSZADU).

- To participate in the competition, candidate Kalin Viliyanov Staykov presented a list of 13 (out of 18 with authorship) titles of scientific publications in the most prestigious Physics journals. Additional 19 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 PURPNSZADU.

2. Details of the applicant

(Short professional and biographical details of the applicant)

Kalin Staykov successfully completed his master's degree in "Physics: Theoretical and Mathematical Physics" at the Faculty of Physics of SU "St. Clement Ohridski" in October 2014 and entered full-time doctoral studies at the department "Theoretical Physics" of the Faculty of Physics in

January 2015. It is impressive, that he was able to obtain a considerable number of substantial scientific results and to prepare his dissertation for defense in a very short time - only one year and 10 months!

From June 2016, he became an assistant professor, and later the chief assistant professor at the Department of Theoretical Physics of the Faculty of Physics of the SU "Kl. Ohridski".

For the period April 2018-September 2020, he is a postdoc at the Faculty of Physics of the SU "Kl. Ohridski".

Dr. Kalin Staykov was the leading researcher of one contract with the National Fund for Scientific Research and a member of four more such contracts.

Dr. Kalin Staykov has three successfully defended diploma students. He was also an editor at the Bulgarian Journal of Physics.

Awards: Dr. Kalin Staykov PhD thesis was awarded as the best thesis for 2016 year. I should mention the most prestigious bulgarian ones: „Pythagores“ for the best young researcher in Bulgaria.

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

The scientific research of Dr. Kalin Staykov reflected in the articles presented for the competition is mainly concentrated on the modeling of compact objects (black holes and neutron stars) and the study of their parameters and properties in modified theories of gravity. A more specific focus that can be traced in the papers is on the study of quasi-normal modes (gravitational waves) of these objects and the study of space-time around them.

- The topics of Dr. Kalin Staykov's research is among the most interesting in contemporary physics in the last decade. The experimental detection of gravitational waves, as well as the discovery of a non-zero cosmological constant, poses new challenges to modern physics. In this context, Dr. Staykov's research is not only relevant, but also represents an important contribution to the field.

- As I already noted above, Dr. Staykov published a total of 18 articles in the most reputable journals with a high impact factor. In addition, there are also 3 conference reports, two of which are published in impact-ranked journals. K. Staykov has selected 13 articles for the competition, almost all of them (11) are from the highest quartile - Q1. This definitely shows the highest quality of his research.

- Another indicator for the impact of the published papers are citations, which also show a high level. The observed independent citations are over 380 and the Hirsch factor is $h=10$.

In conclusion:

a) the scientific works meet the minimum national requirements (according to Article 2b, paragraphs 2 and 3 of the RSARB) and, accordingly, the additional requirements of the SU "St. Kliment Ohridski" for occupying the academic position of "associate professor" in the scientific field and professional direction of the competition;

b) the scientific works and materials presented by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position; This is reflected in the tables presented in the applicant's documents.

c) there is no evidence of plagiarism in the scientific works submitted for the competition.

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

I would summarize K. Staykov's teaching experience as follows.

Dr. Kalin Staykov has an intensive teaching activity. His academic load not only meets the university's horary requirements, but exceeds them by a lot.

As a lecturer, Kalin has lectured on: Ordinary Differential Equations, Vector and Tensor Analysis, General Relativity. He replaced colleagues on their leaves in a number of other lectures.

Dr. Staykov has conducted a large number of seminar exercises such as on Mathematical Analysis, Ordinary Differential Equations, Vector and Tensor Analysis, Complex Analysis, Partial Differential Equations.

The quality of Kalin Staykov's teaching is very high, which is why he is often sought after for additional consultations and discussions.

Chief Associate Professor Kalin Staykov supervised three successfully defended diploma theses students.

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

Below I will provide a brief description of the merits of the applicant's achievements.

a) It is a well-known fact that, due to the non-zero infrared fixed point, General Relativity is not renormalizable. One approach to solving this problem is to add invariants coupled to a scalar field, while the field equations remain of second order. One option in such an approach is the quadratic invariant of Gauss-Bonnet gravity. The approach is particularly effective in the case of systems with large curvature like black holes, neutron stars, etc. allowing to bypass the so-called "no hair" theorems. The equations are extremely complex, which makes the numerical approach very efficient. Kalin Staykov's contributions to this problematics mainly consist of numerical solutions for black holes with scalar hair and study of their properties. I would note that Kalin made a significant contribution to the numerical study of quasinormal black hole modes for the case of Gauss-Bonnet gravity with a massive self-interacting scalar field.

b) Spontaneous scalarization processes in the case of Gauss-Bonnet gravity with multiple scalar fields are investigated. Numerical solutions were obtained for processes with and without spontaneous scalarization, and the profiles of the emitted gravitational waves and the frequencies and decay times were obtained.

c) The last direction I would like to stress on is scalar-tensor theories and $f(R)$ gravity. Dr. Staykov has made a significant contribution in this field for the case of $f(R) = R + aR^2$ gravity, and a number of universal ratios have been obtained for different dimensionless combinations of parameters of compact objects or of the frequencies of their quasi-normal modes. The analysis of this type of relationship and their interpretation provides valuable information for a wide class of models.

All results for published in prestigious international journals. As a final touch, I will once again recall the scientometric data: **11 articles with Q1, 1 with Q2, 1 with Q3; citations 380; h=10.**

6. Critical notes and recommendations

I have no substantive criticisms, but I do have one recommendation. Kalin is engaged too much in teaching activities, which undoubtedly affects his scientific activity. I would recommend that Kalin reduce his commitments a bit.

7. Personal impressions of the applicant

I know the candidate since his student years. I have witnessed the growth of Kalin Staykov from student to doctor, postdoc and senior assistant. His participation in projects under the National Research Fund is mentioned in the materials, but I would like to note that I witnessed the significant contributions to the collectives in which he participated. During the time of our acquaintance, I witnessed Kalin's dedication to theoretical physics and the science with which he connected his professional realization. I can say that his competence and professionalism deserve the highest rating. As a person, Kalin is a wonderful colleague who you can always count on.

8. Conclusion on the application

Having familiarized myself with the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, **I confirm** that the scientific achievements not only meet, but also exceed the requirements of ZRASRB, the Regulations for its application and the corresponding Regulations of the SU "St. Kliment Ohridski" for the candidate to occupy the academic position of "associate professor" in the scientific field and professional direction of the competition. In particular, the candidate satisfies the minimal national requirements in the professional field and no plagiarism has been found in the scientific works submitted for the competition.

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

II. Overall Conclusion

Based on the above, I strongly recommend the scientific jury to propose to the competent authority for the selection of the Faculty of Physics at SU "St. Kliment Ohridski" to elect Ch. Assistant Professor **Kalin Vilianov Staykov, Ph.D., to take the academic position of "associate professor"** in professional direction 4.1 Physical Sciences.

22.08.2022

Signature:
(Prof. Dr. Radoslav Rashkov)