

О P I N I O N

regarding the competition for academic position "Associate Professor"
at the Faculty of Physics, Sofia University "St. Kliment Ohridski"

Professional field: 4.1 Physical Sciences (*General Theory of Relativity and Relativistic Astrophysics*), announced in State Newspaper № 30 on 15.04.2022.

Candidate: Assist. Prof. dr. Kalin Staykov, Faculty of Physics, Sofia University

Referee: Assoc. Prof. D.Sc. Lilia Anguelova, INRNE, Bulgarian Academy of Sciences

1. Concise Scientific Biography

Kalin Staykov earned his PhD degree from the Faculty of Physics at Sofia University "St. Kliment Ohridski" in 2016. Before that, he earned a master's degree in theoretical and mathematical physics in 2014 again from the Faculty of Physics, Sofia University "St. Kliment Ohridski". Since 2017 he is an assistant professor at the "Theoretical Physics" department of the Faculty of Physics, Sofia University "St. Kliment Ohridski". Also, during 03.2018 – 06.2019 he was an assistant editor of the scientific journal "Bulgarian Journal of Physics". It is worth noting that during 2022 he won the prestigious award "Pythagoras" (transliteration from Bulgarian: "Pitagor") for young scientists in the area of natural and engineering sciences.

2. Overall description of the documents of the candidate

Dr. Staykov has submitted all necessary documents, according to the rules of the current competition. This includes (without being limited to) the following: CV, diplomas for higher education and for master's degree, PhD diploma, certificate for work experience in his field of research, lists of all publications and of selected publications for the competition, a completed standard form attesting that the minimal national criteria for the position are satisfied, as well as a summary of his personal scientific contributions.

3. Publications and their impact in the scientific literature

Dr. Staykov has submitted 18 publications in international scientific journals with impact factor, as well as three in conference proceedings. Almost all of the selected for the competition 13 scientific papers are published in very prestigious international journals with quartile Q1, like Physical Review D and European Physical Journal C. As is clear from his documents, the candidate fully satisfies all national minimal criteria, as well as the additional

requirements of the Faculty of Physics at Sofia University. It should be noted that he has more than 400 independent citations (according to the world scientific archive in high energy physics <https://inspirehep.net/>) and an h-factor of 11. This shows that his research is consistently at a high level and, deservedly, is receiving international recognition.

4. Overall research characteristics and main contributions

Dr. Staykov's research is devoted to the study of modified theories of gravity. Modern observational data motivate the consideration of modifications to the General Theory of Relativity on cosmological scales, due to the need to explain the nature of dark energy and dark matter. Investigating the consequences of such modifications for compact astrophysical objects, such as black holes and neutron stars, is of great importance for the potential verification (or ruling out) of different theoretical possibilities. As a result, Dr. Staykov's research is in an area of theoretical physics, which currently attracts a great deal of interest. He has investigated a number of problems in Gauss-Bonnet gravity with or without scalars, as well as in scalar-tensor theories and $f(R)$ theories of gravity. Among his main contributions are the following:

- Obtaining numerical black hole solutions with scalar hair in Gauss-Bonnet gravity with a massive scalar.
- Obtaining numerical black hole solutions with spontaneous scalarization in Gauss-Bonnet gravity with a self-interacting massive scalar field. Numerical investigation of the axial quasinormal modes of these black holes and determination of the corresponding oscillation frequencies and damping times.
- Obtaining numerical solutions describing scalarized non-topological neutron stars in Gauss-Bonnet gravity with multiple scalar fields.
- Building numerical models of rotating neutron stars in scalar-tensor theories and $f(R)$ theories of gravity. Investigation of universal relations between the normalized moment of inertia and the compactness of these neutron stars.
- Modeling of neutron stars in scalar-tensor theories with a massive self-interacting scalar field and numerical computation of the orbital and epicyclic frequencies of particle motion around them.
- Numerical computation of the relation between the moment of inertia of the crust and the full moment of inertia of a neutron star in scalar-tensor theories and $f(R)$ theories of gravity, which is of interest due to observations of sudden brief increases in the angular velocity of neutron stars.

5. Teaching experience

Dr. Staykov has extensive teaching experience, as is evident from his educational activity report. During the period 2016 – 2021 he has amassed about 2000 hours of pedagogical activities in the Faculty of Physics at Sofia University "St. Kliment Ohridski".

6. Other issues

a) *Scientific projects and other activity:* The candidate has participated in 4 scientific projects with the Fund for Scientific Research (transliteration from Bulgarian: "FNI") and has been the principle investigator in another such project. Also, he has had three extended scientific visits in Tübingen University, Germany.

b) *Critical remarks:* None.

CONCLUSION

In view of all of the above, my opinion is that dr. Kalin Staykov undoubtedly satisfies fully all criteria for this competition. Hence, I strongly recommend his election for Associate Professor at the Faculty of Physics of Sofia University "St. Kliment Ohridski".

26.08.2022 г.

Assoc. Prof. D.Sc. Lilia Anguelova