

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 № 67 on 28.07.2020.

Candidate: Assist. Prof. dr. Galin Gyulchev, Faculty of Physics, Sofia University

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

1. Concise Scientific Biography

Galın Gyulchev earned a bachelor's degree in physics in 2004 and a master's degree in theoretical and mathematical physics in 2006 at the Faculty of Physics, Sofia University "St. Kliment Ohridski". In 2010 he completed a doctorate in physics on the topic of gravitational lensing at the Faculty of Physics, Sofia University "St. Kliment Ohridski". During 2011 – 2019 he was an assistant professor at the "Physics, Biophysics and X-rays" department of the Medical Faculty, Sofia University "St. Kliment Ohridski". From 2019 on he is an assistant professor at the "Theoretical Physics" department of the Faculty of Physics, Sofia University "St. Kliment Ohridski".

2. Overall description of the documents of the candidate

The candidate has submitted all documents required by the rules of the competition. This includes (but is not limited to) the following: CV, diploma for master's degree, PhD diploma, certificate for work experience in his field of research and teaching, list of publications, list of citations, as well as a completed standard form attesting that the minimal national criteria for the position are satisfied.

3. Publications and their impact in the scientific literature

The candidate has submitted 11 publications in international scientific journals with impact factor, incl. Phys. Rev. D, Phys. Rev. Lett., Eur. Phys. J. C, Annals of Physics. (10 of them were already published at the time of submission of the documents for this competition. In addition, one more preprint was accepted for publication afterwards.) The candidate has submitted also numerous conference proceedings, as well as a monograph. The total impact factor of the submitted works is 49.4. The number of their independent citations, noticed so

far, is 337. Finally, the h-factor of the candidate is 7, which is indicative of a consistently good level of research on his part.

4. Overall research characteristics and main contributions

Dr. Gyulchev's research is in a very important and active area of modern theoretical physics, namely the investigation of compact astrophysical objects in the General Theory of Relativity as well as in modified theories of gravity. He has studied a wide range of problems in this area, focusing especially on gravitational lensing due black holes and naked singularities. He has also performed in-depth investigations of black hole quasinormal modes, as well as shadows of black holes and wormholes. His main contributions can be summarized as follows:

a) Gravitational Lensing

- He has studied the effect on the deviation of light rays, due to gravitational lensing from certain classes of black holes in a type of modified gravitational theories. More precisely, he has investigated rotating black holes (with or without charge) in dilaton, as well as dilaton-axion, Einstein-Maxwell gravity.
- He has studied the effect of gravitational lensing due to the dilaton-axion black hole of Kerr-Sen in the heterotic string theory.
- He has investigated the consequences of gravitational lensing due to a naked singularity in Einstein gravity coupled to a massless scalar field.
- He has analyzed the deviation of massive particles caused by gravitational lensing, due to either the naked singularity of Janis-Newman-Winicour or to a Kerr-like wormhole, in order to develop observational tests for distinguishing between these two solutions.
- He has shown how the gravitational lensing effect, due to a certain galactic cluster, is modified by the dark matter present in the cluster.

b) Quasinormal modes and quasiperiodic oscillations

- He has found important relations between the quasinormal modes of spherically-symmetric black holes and their gravitational lensing effects.
- He has investigated the quasiperiodic oscillations of X-ray binary stars.

c) Shadows of Compact Objects

- He has studied the shadow of rotating traversable wormholes and shown that, in a class of such solutions, the throat is a potential barrier for light rays with certain impact parameters.
- He has investigated the physical mechanisms for the formation of two wormholes solutions of this type.

5. Teaching experience

Dr. Galin Gylchev has an extensive teaching experience. He has taught lecture courses and recitation sections on Mathematical Methods in Physics, Electrodynamics, Partial Differential Equations, Theoretical Astrophysics etc.. Also, he has supervised lab work in physics for various other majors, including medicine, chemistry and biology. In addition, he has been the supervisor of a successful bachelor student.

6. Other issues

- a) Scientific projects and other activity:* The candidate has taken part in 12 scientific projects, having been the principle investigator in 2 of them. Additionally, he has been playing an active role in the leadership of the "Union of Physicists in Bulgaria" and, also, has been a long-time referee for the competition "1000 Stipends" of foundation "Communitas".
- b) Criticl remarks:* None.

CONCLUSION

Based on all of the above, I believe that dr. Galin Gylchev satisfies beyond any doubt all of the criteria for this competition. Therefore, I strongly recommend his appointment as associate professor at the Faculty of Physics of Sofia University "St. Kliment Ohridski".

20.11.2020 г.

Assoc. Prof. D.Sc. Lilia Anguelova