REPORT

by PROF. D.SC. MANCHO HRISTOV MANEV
Faculty of Mathematics and Informatics
University of Plovdiv "Paisii Hilendarski"
on material submitted for participation in a competition
for holding the academic position **"Associate Professor"**
Area of higher education: 4. Natural Sciences, Mathematics and Informatics
Professional field: **4.5 Mathematics**
Scientific speciality: "Geometry"
Department of Geometry, Faculty of Mathematics and Informatics
University of Sofia "St. Kliment Ohridski"

1. Subject of review

In the competition for the academic position (AP) "Associate Professor", announced in the State Gazette, issue 21 of 13.03.2020 for the needs of the Department of Geometry of Faculty of Mathematics and Informatics (FMI) at Sofia University (SU) as the only candidate involved Chief Assistant Professor Dr. ALEXANDER VLADIMIROV PETKOV from the same department.

By order No. RD38-266/10.07.2020 of the Rector of SU I was appointed a member of the Scientific Jury in the competition described above. According to the decision of this jury (Minutes No. 1/22.07.2020) I am determined to write a report for the competition.

In my role of a member of the Scientific Jury, I have received the documents attached to the application of 9.07.2020 of Ch. Asst. Prof. Dr. Alexander Petkov to the Rector of SU for participation in the competition.

This set of documents and materials allows for an objective and complete assessment of the candidate in accordance with the requirements of the Development of the Academic Staff in the Republic of Bulgaria Act (DASRBA), the Rules on the Terms and Conditions for Acquisition of Scientific Degrees and Holding Academic Positions at Sofia University "St. Kliment Ohridski" (RTCASDHAP at SU).

2. Academic development of the candidate

Candidate for Associate Professor Alexander Vladimirov Petkov was born on December 17, 1985 in Montana. He graduated from FMI at SU with a Bachelor's degree in

Mathematics in 2008 and a Master's degree in Dynamical Systems and Geometry in 2010. On April 29, 2014 he defended an Educational and Scientific Degree (ESD) "Doctor" (PhD) in Geometry at SU after a regular doctorate from 2011 to 2014 in the Department of Geometry at FMI of SU with a supervisor Corresponding Member Prof. DSc Stefan Ivanov.

He began his teaching career in 2014 in the same department with exercises in several disciplines, first as a mathematician and later that year on the AP "Chief Assistant Professor". His experience in the specialty is 9 years and 2 months.

Alexander Petkov began his scientific career with a regular doctorate at FMI of SU and his successful defence in 2014 of a dissertation for ESD "Doctor" in the scientific specialty "Geometry" on the topic "Riemannian and sub-Riemannian manifolds with structures". After that he actively continued his development and twice in 2017 he completed 3-month postdoctoral specializations at the Institute of Mathematics of the Faculty of Mathematics at the Vienna University, Austria. For the next two years, he was a visiting scientist for several months at the Department of Mathematics at the Miami University, Florida, USA. In 2019, for 9 months as a young scientist at SU, he participated in the implementation of the MES program "Young Scientists and Postdoctoral Fellows". He speaks three foreign languages very well: English, French and Russian.

I know very well the scientific achievements of Ch. Asst. Prof. Dr. Alexander Petkov for almost 8 years since his reports at scientific conferences and his publications in prestigious mathematical journals. I consider Dr. Petkov as a young and promising researcher in the field of differential geometry and its applications in mathematical physics.

3. General characteristics of the works submitted for the competition

The list of scientific publications of Dr. Alexander Petkov, submitted for participation in the competition, contains 6 titles. Of these, 5 are articles in impact factor (IF) journals totalling a remarkable 5.230, three in Q1 (numbered [1], [3] and [4]) and two in Q4 ([5] and [6]). In addition, 1 article ([2]) is in a journal indexed in Zentralblatt MATH.

According to the Annex to art. 1a, para. 1 of RADASRBA for Area 4, PF 4.5, the fulfillment of the Minimum National Requirements (MNR) for AP "Associate Professor" by groups of indicators by the candidate Dr. Alexander Petkov is given in Table 1.

All publications participating in the competition are in English, as 3 are individual, 1 article is with 1 co-author, and 2 are with 2 co-authors. The publications cover the requirements under Indicators 4 and 7 with a total of 315 points. Under Indicator 11, evidence for 8 citations for a total of 64 points is presented.

Table 1. Fulfillment of the MNR by Dr. Alexander Petkov

Groups of indicators	Indicators	Required number of points	Presented number of points
Group A	Indicator 1	50	50
Group V	Indicators 3 and 4	100	111 (Indicator 4)
Group G	Indicators from 5 to 10	200	204 (Indicator 7)
Group D	Indicator 11	50	64

I have not noticed any form of plagiarism in the articles presented by Dr. Alexander Petkov.

The candidate for associate professor Dr. Petkov fully satisfies all general requirements for AP "Associate Professor", provided in art. 24 of DASRBA, art. 53 of RADASRBA and art. 105, art. 107 and art. 112 of RTCASDHAP at SU.

4. Characteristics of the scientific papers participating in the competition

The candidate's research is focused at studying the differential geometry of quaternionic contact (abbr. QC) manifolds.

In [1], a sharp lower bound of the eigenvalues of the sub-Laplacian is found on a compact 7-dimensional QC manifold, assuming a lower bound on the $Sp(n)Sp(1)$-components of the QC-Ricci curvature, as well as the positivity of the P-function of any eigenfunction. It has been shown that in the case of a 7-dimensional compact 3-Sasakian manifold the lower bound is reached if and only if the QC manifold is the round 3-Sasakian sphere.

In [2], a theorem of the type of the classical Lichnerowicz theorem is also proved, giving a sharp lower bound of the first nonzero eigenvalue of the sub-Laplacian on a compact 7-dimensional QC manifold, assuming a lower bound of the QC-Ricci tensor, the torsion tensor and its distinguished covariant derivatives.

In [3], a formula for the sub-Laplacian on a QC manifold is found by which a lower bound of the eigenvalues of the sub-Laplacian is found, assuming a lower bound of the $Sp(n)Sp(1)$-components of the QC-Ricci curvature. A priori integral inequalities for the squares of the horizontal derivatives of smooth compactly supported functions have also been established.

In [4], it is found that the QC Yamabe problem has a solution on any compact QC manifold that is not locally QC equivalently to the standard 3-Sasakian sphere, i.e. a QC conformal QC structure exists having a constant QC scalar curvature.

In [5], an entropy formula is found for the QC heat equation on a compact QC manifold. As a result, the monotonicity of the QC energy functional is established, if some a priori conditions for positivity of the so-called *P*-function.

In [6], an alternative proof of the results of [1], [2] and [3] concerning a sharp lower estimate of the first eigenvalue of the sub-Laplacian on a compact QC manifold is given, provided a Lichnerowicz-type condition and the essential positivity of the *C*-operator. The entropy formula for the heat equation on a compact QC manifold, found in [5], is used.

CONCLUSION

Based on the analysis made, I reckon that the candidate in the announced competition Ch. Asst. Prof. Dr. Alexander Vladimirov Petkov, fully meets the requirements of the Development of the Academic Staff in the Republic of Bulgaria Act (DASRBA), the Regulations for the Application of the DASRBA (RADASRBA) and the Rules on the Terms and Conditions for Acquisition of Scientific Degrees and Holding Academic Positions at Sofia University "St. Kliment Ohridski" (RTCASDHAP at SU) for holding the AP "Associate Professor".

As a result, I find it reasonable to give my ***positive assessment*** and to recommend to the Scientific Jury to propose to the Faculty Council of the Faculty of Mathematics and Informatics at the Sofia University ***to elect*** Dr. ALEXANDER VLADIMIROV PETKOV to the academic position of ***"Associate Professor"*** at the Sofia University in the Area of higher education 4. Natural Sciences, Mathematics and Informatics, Professional field 4.5. Mathematics, Scientific specialty "Geometry".

01.09.2020 Signature:

Plovdiv, BG

(Prof. D.Sc. Mancho Manev)