OPINION

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for occupation of an academic position of "Associate Professor"
in professional field 4.5 Mathematics, scientific specialty "Equations of Mathematical Physics"

The competition for associate professor has been announced in the State Gazette, issue no. 108 of 22. 12. 2020 for the needs of the section "Differential equations and mathematical physics" at IMI-BAS. The only candidate in the competition is Ch. Assistant Professor Dr. Tihomir Ilchev Valchev from the same section.

1. Brief biographical data about the candidate

Tihomir Valchev received a bachelor's degree in physics in 2002 and a master's degree in theoretical and mathematical physics in 2003 from the Faculty of Physics at Sofia University "St. Kliment Ohridski ". In 2009 he was awarded the educational and scientific degree "Doctor" in the scientific specialty 01.03.01 "Theoretical and Mathematical Physics" after defending a dissertation on "Reductions of nonlinear equations of soliton type on homogeneous and symmetric spaces."
In the period 2009 - 2014 he was a chief assistant at the INRNE-BAS. Since 2015 he has been working as a senior assistant in the section "Differential Equations and Mathematical Physics" at IMI-BAS. It should also be noted that in the period 2012-2014 he was a postdoctoral fellow at the Dublin Institute of Technology (Ireland), where he conducted research in the field of integrable systems.

2. General description of the submitted materials

The applicant has submitted the following mandatory documents:
1) professional CV according to the European model
2) diplomas for completed higher education: bachelor's and master's degrees
3) diploma for the educational and scientific degree "Doctor"
4) a list of all the candidate's publications
5) a list of the publications with which the candidate participates in the competition

6) reference for the original scientific contributions in the publications with which he participates in the competition

7) summary of the publications with which he participates in the competition

8) copies of the publications with which he participates in the competition

9) list of all citations

10) list of citations of the publications for participation in the competition

11) a copy of the announcement in the State Gazette

12) certificate for work experience in the specialty

13) a list of the research projects in which the applicant participates or is a leader

All documents submitted by the applicant comply with the requirements of the Law for the Development of Academic Staff in the Republic of Bulgaria.

3. Publications and their impact in the scientific literature

The candidate has submitted 15 publications for participation in the competition, 7 of which are articles in international scientific journals with impact factor, 1 in a journal without impact factor, but indexed in SCOPUS, and 7 in conference series indexed in SCOPUS. The presented publications have a total impact factor of about 7. The noticed independent citations of these publications are 28.

The complete list of scientific papers of the candidate includes 42 titles, 11 of which are articles in international scientific journals with impact factor. All of the candidate's publications have been cited a total of 104 times. The overall H-index of the candidate is 7 according to SCOPUS and 10 according to GOOGLE SCHOLAR.

The candidate satisfies national as well as the specific requirements of IMI-BAS for holding the academic position of "Associate Professor" in the professional field 4.5 Mathematics.

4. General characteristics of the scientific activity and main contributions

The scientific works of Dr. Tihomir Valchev, with which he participated in the competition, are devoted to various issues in the theory of continuous integrable systems. In particular, the candidate investigates systems of partial differential equations of two independent variables that are integrable in terms of the inverse scattering problem method (ISM). His most important contributions can be divided into the following groups.

A) Quadratic bundles

This group includes works [7], [10] and [11]. They are dedicated to scattering operators $L(\lambda)$, which are quadratic polynomials of the spectral parameter λ with coefficients in some simple complex (matrix) Lie algebra g. One of the main issues addressed in this group of works is the development of the formalism of the real problem of scattering under zero boundary conditions. Jost solutions, fundamental analytical solutions and scattering data (matrix) are introduced, and the connection of the ISM with a local Riemann-Hilbert problem is studied. The effect of the imposed reduction conditions on the solutions and scattering data is also considered. This allows the spectral properties of the scattering operator to be described. The other focus of the group of works [7], [10] and [11] is the construction of non-reflective potentials for quadratic beams and their corresponding soliton-type solutions.

B) Equations of magnetic type

This group includes works [1-6] and [12-15]. They focus on multicomponent nonlinear evolution equations (NEEs), analogs of the Heisenberg ferromagnet equation. The main goal of the works in this group is to construct and study $1+1$-dimensional NEEs, which, like Heisenberg's equation, are S-integrable. Two types of NEEs have been studied. The first type of NEEs has a scattering operator $L(\lambda)$, which depends linearly on the spectral parameter λ similar to the Heisenberg equation, but the main difference with it is that the Lax representation is associated with Hermitian symmetric spaces, which requires the imposition of a more general algebraic relation on the potential. The second type of studied NEEs have a Lax representation of the type of rational bubdle, again connected with Hermitian symmetric spaces.

C) Other works

This group includes works [8] and [9]. In [9] for the first time a possible generalization of the concept of reduction (in the sense of Mikhailov) is considered, which opens the possibility for group theoretical study through ISM of certain classes of nonlocal NEEs such as the non-local Schrödinger equation of Ablovitz and Muslimani. Another advantage of the mentioned generalization is that it gives a systematic approach for constructing solutions of fully integrable equations having predefined discrete symmetries.

In [8] an approach was developed for constructing solutions of quasi-rational type for multicomponent NEEs, integrable with the help of ISM. The approach is based on the Zakharov-Shabat dressing method with a dressing multiplier, which is a meromorphic function with simple poles on the spectral parameter. As an illustration of the approach, the construction of quasi-rational solutions with zero asymptotics for a multicomponent nonlinear Schrödinger equation and of quasi-rational solutions with constant asymptotics for a two-component system of magnetic type is considered.

5. Other issues

1) Scientific projects

Dr. Tihomir Valchev is the leader of 1 project, and has also participated in two other projects with the Research Fund of Bulgaria. He participated in a bilateral project Reductions of Nonlinear Evolution Equations with the Royal Society and was awarded an individual grant by
Irish Research Council.

2) Critical remarks

I have no critical remarks on the merits. I would recommend the candidate to expand the field of study by going beyond integrable systems.

6. Conclusion

Based on the above analysis, I propose Ch. Assistant Professor Dr. Tihomir Valchev to be elected "Associate Professor" in the professional field 4.5 Mathematics, scientific specialty "Equations of Mathematical Physics" for the needs of the section "Differential Equations and Mathematical Physics" at IMI-BAS.

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