



Bremen, December 23, 2015

OPINION

By: Prof. Dr. Ivan Penkov, Jacobs University Bremen
Regarding: The application of the following candidates for the academic position of **FULL PROFESSOR OF MATHEMATICS** according to the Bulgarian legislation at the American University in Bulgaria in Area of Higher Education 4. Natural Sciences, Mathematics, and Informatics in Professional Field 4.5 Mathematics. The procedure has been announced in the State Gazette issue 69 dated September 8, 2015.

Candidate 1: **Assoc. Prof. Tatyana Gateva-Ivanova**

I present the evaluation below in my capacity as a member of the Academic Jury appointed for the above mentioned procedure by a letter of the AUBG President dated November 6, 2015. This evaluation is based on the *Development of Academic Staff in the Republic of Bulgaria Act*, the Rules for its implementation, the internal AUBG rules, regulations, and policies, including the *Habilitation Procedure* and the advertisement on the AUBG website regarding the procedure.

Evaluation of the Applicant

I. Basis for Evaluation

This evaluation is based on the documents submitted by the candidate and on the candidate's publications. Most of the publications of the candidate are in refereed journals, some of which are very prominent.

II. Eligibility

In my opinion, Assoc. Prof. Tatyana Gateva-Ivanova is a fully eligible candidate for the position of Full Professor of Mathematics at AUBG. Please find the eligibility checklist enclosed.

III. Areas of Research of the Candidate. Evaluation of the Contributions of the Candidate.

As stated in the Additional Requirement List (enclosed), the candidate has conducted research in the following areas:

- Algebra;
- Noncommutative algebra;
- Quantum algebra;
- Yang-Baxter equations and related algebraic objects;
- Artin-Schelter regular algebras;
- Combinatorial methods in noncommutative algebra: finitely presented algebraic structures;
- Quadratic algebras.

Assoc. Prof. Tatyana Gateva-Ivanova is an established researcher in the area of abstract algebra. Her scientific roots are in the Soviet School of Algebra in Moscow. In the last 25 years, she has had a prominent international career, in particular, she has collaborated with world's leaders in her field. She has also been a visitor of most prominent scientific institutions such as the Massachusetts Institute of Technology, the Max-Planck-Institute for Mathematics in Bonn, etc.

In the 1990s, Tatyana Gateva-Ivanova's main topic of study was Noetherianity of finitely presented algebras. In a series of papers [GI91], [GI91a], [GI94], and [GI96], she established herself as a notable researcher and obtained interesting and important results.

Later Tatyana Gateva-Ivanova widened her research field by joining the rapidly developing bridge between the structure theory of associative algebras and the newly developed methods in quantum groups. In particular, Tatyana Gateva-Ivanova studied Yang-Baxter algebras, which in turn are related to the set-theoretic solutions of the Yang-Baxter equations. In her remarkable paper [GI12] published in the *Advances in Mathematics*. Gateva-Ivanova has established a spectacular theorem. claiming that, for an n -generated quantum binomial algebra A , the following conditions are equivalent:

- (i) A is a PBW algebra with finite global dimension;
- (ii) A is PBW and has polynomial growth;
- (iii) A is an Artin-Schelter regular PBW algebra;
- (iv) A is a Yang-Baxter algebra;
- (v) $HA(z) = 1/(1-z)^n$;
- (vi) The dual A' is a quantum Grassmann algebra;
- (vii) A is a binomial skew-polynomial ring.

As a consequence, for quantum binomial algebras the problem of classification of Artin-Schelter regular PBW algebras of global dimension n is equivalent to the classification of square-free set-theoretic solutions of the Yang-Baxter equation (X, r) , on sets X of order n .

In my opinion, the above is the very best result of Tatyana Gateva-Ivanova for the last decade.

Nevertheless, she has obtained a number of other very interesting results, which I would like to mention in this opinion. Among her older papers, I would like to point to the joint work with Van den Bergh [GI98], in which they introduced a semigroup approach to the set-theoretic solutions of the Yang-Baxter equations. This paper has had considerable impact on the field, in particular on Gateva-Ivanova's own later work.

Next, I would like to mention Tatyana Gateva-Ivanova's joint work with S. Majid, in particular the paper [GIM08], in which they study the finite set-theoretic solutions to the Yang-Baxter equation of square-free multipermutation type. This work has a follow-up, namely, Gateva-Ivanova's joint work with Peter Cameron [GIC]. This latter paper gives strong structural results about the set-theoretic solutions of the Yang-Baxter equation.

Finally, it is impossible not to mention the following remarkable conjecture made by Tatyana Gateva-Ivanova: every multipermutation of level m is a strong twisted union of solutions of levels at most $m - 1$. This conjecture turned out not to hold true: recently, Leandro Vendramin constructed an infinite family of square-free solutions which do not arise from solutions of level at most $m - 1$. Nevertheless, remarkably, Gateva-Ivanova's conjecture was "almost correct": a computer study showed that in all solutions of size ≤ 8 (there are 2471 such solutions), only one example contradicts the conjecture.

There is no point to continue describing interesting results of Tatyana Gateva-Ivanova in this brief opinion. It is worth stating, however, that Gateva-Ivanova continues her research at a very active pace, and that she has posted online several new results which will appear in journals in the near future.

In conclusion, I am fully convinced that Assoc. Prof. Tatyana Gateva-Ivanova's scientific contributions have earned her the rank of Full Professor of Mathematics at any decent research university, in particular, at the American University in Bulgaria.

IV. Evaluation of the Candidate's teaching

I have no other basis for judgement of Assoc. Prof. Tatyana Gateva-Ivanova's teaching other than the documents submitted in her application. Based on these documents, I conclude that

- Tatyana Gateva-Ivanova is teaching a wide range of interesting courses with very good enrolment;
- Tatyana Gateva-Ivanova's teaching evaluations are excellent;
- she really cares about her students' advancing in the materials, and that she is evidently successful in that.

The candidate's areas of teaching correspond to the Additional Requirements (attached). The candidate's teaching experience is clearly more than sufficient to satisfy the requirements of the current procedure.



V. Major critical notes and recommendations

None.

VI. Conclusion

In my opinion, Assoc. Prof. Tatyana Gateva-Ivanova clearly satisfies all requirements for Full Professor of Mathematics at AUBG, and I recommend without any hesitation that she be granted the rank of Full Professor.

Signature and date: 23.12.2015

I. Penke

By signing here I also declare that writing this review does not represent conflict of interest.

 American University in Bulgaria

Eligibility Checklist

Name of the Candidate: **Assoc. Prof. Dr. Tatyana Gateva-Ivanova**
Applying for: **Full Professor in Mathematics**
In the Professional Field: **4.5 Mathematics**

Check below what applies. Sign and submit together with your review or opinion.

- The Candidate has Ph.D;
- The Candidate has served five years as (Senior) Assistant Professor (for applicants for Associate Professor) or six years as Associate Professor (for applicants to Full Professor) at a recognized academic institution;
- The Candidate has published a monograph or publications of equal standing in specialized journals. These should not repeat publications based on which Ph. D., or Doctor of Science degree, or Associate Professor Rank was granted;
- For applicants for Full Professor: The Candidate has other original research works, publications, and other theoretical or applied-theoretical works;
- The Candidate has experience from recognized academic liberal arts institution(s);
- The Candidate has experience in student-centered teaching approach;
- The Candidate has undergone at least one successful evaluation in teaching, research and service at a recognized academic liberal arts institution, including positive student evaluations of teaching.
- The Candidate has experience in teaching in English at a higher education institution with instruction in English language.
- AUBG can ensure teaching and research load according to its internal rules and regulations.

Signature and date:

23.12.2015

I. Penkov

American University in Bulgaria

Additional Requirements

For Professor Academic Position in Professional Field 4.5 Mathematics

- Additional specifications: algebra, noncommutative algebra, quantum algebra, Yang-Baxter equations and related algebraic objects, Artin-Schelter regular algebras, combinatorial methods in noncommutative algebra: finitely presented algebraic structures, quadratic algebras

Name of the Candidate: **Assoc. Prof. Dr. Tatyana Gateva-Ivanova**

Check below what applies. Sign and submit together with your review or opinion.

Research

The Candidate has conducted research in the following areas:

- Algebra;
- Noncommutative algebra;
- Quantum algebra;
- Yang-Baxter equations and related algebraic objects;
- Artin-Schelter regular algebras;
- Combinatorial methods in noncommutative algebra: finitely presented algebraic structures;
- Quadratic algebras.

Teaching

The Candidate has teaching experience in the following areas:

- Yang-Baxter equations and associated algebraic objects;
- Abstract Algebra;
- Group Theory;
- Galois Theory;
- Lie algebras;
- Ideals, varieties, and algorithms;
- Finite presentability, Groebner bases, normal forms (diamond lemma);
- Linear algebra;
- Multivariate Calculus and Geometry.

Signature and date:

23.12.2015 