

Report (opinion)

by **Vesselin Tonchev**, PhD,

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Within the procedure for obtaining the scientific degree Doctor of Science

Dissertation written by: Roumen Tsvetanov Tsekov, PhD, Professor at the Faculty of Chemistry and Pharmacy, Sofia University

I got acquainted with documents presented by Prof. Dr. Roumen Tsekov and before stating briefly, as for a report, my opinion and recommendation I will make a slightly different section of his scientific production, based on objectively available on the Internet, data.

According to Google Scholar the papers of Roumen Tsekov are cited 1712 times (including those after 2016 that are 522), his h-index is 22 (9) and his i10-index (papers with more than 9 citations) - 67 (9). Since Scholar has no functionality to disregard self-citations from all authors, follows the data from Scopus as well. There one finds 115 papers by Prof. Tsekov with 735 citations and an h-index of 14, these 14 articles are published in the period 1994-2010, i.e. after Prof. Tsekov defended his PhD thesis from the (then) Faculty of Chemistry – SU, and before being habilitated as Professor in the same Faculty, and, I think, they do not overlap with those on which is based the current dissertation. The citations of the 32 articles published after 2011 are 58. For me this section is a clear sign that Prof. Tsekov has focused his studies in the last years on all those topics that he considers important and that are the subject of the current dissertation, going mostly beyond these of the classical Physical Chemistry, and I have no doubt that an exciting development is forthcoming until the scientific community will accept and integrate into the scientific paradigm the ideas and results on Prof. Tsekov. Such an opinion is reinforced by a set of facts, from which I selected some more interesting. For example, the first paper included in this dissertation - in CPL'1992 (co-authored with G. Vaisilov) and entitled Quantum Brownian motion and classical diffusion, has until now 2 citations but marks ideas that have spanned the entire career

of Prof. Tsekov. The extremely interesting idea to assign temperament to the living cells (as an analogue of the temperature in the azoic systems) has received only 3 citations for the 8 years since being published in Chinese Physics Letters in 2013.

Yet another, slightly more lateral, perspective. The online archive of the Faculty of Chemistry and Pharmacy (FCF) contains materials on three other defenses from the last 5 years for obtaining the scientific degree "Doctor of Science" - from 2016, 2017 and 2018, i.e. the forthcoming defense occurs three years after the last one. So are they in the online archive of the Faculty of Physics (FzF) but two of them are from this year. We can conclude without much claim to statistical reliability that there is a certain revival of interest in this scientific degree, although behind different driving forces could be assumed - in FzF the scientific degree "Doctor of Science" is a mandatory step on the path to professorship while in FHF it is not. In this sense, Prof. Tsekov deserves admiration for the endeavor, and it, as we shall see below, is quite successful.

The presented dissertation is written in English on 247 pages where the pages after 38 are appendices - the articles on which the dissertation is based. Thus, the dissertant was able to present his ideas in the first 34 pages then come the 10 conclusions, which are impressive themselves, and, somewhat unusually, a bibliographic list containing only the 35 articles that are submitted to obtain degree. The real part, the first 34 pages, is well structured and written with an impressive range of ideas, a kind of *tour de force*, and presents in a concise form and with the help of 28 numbered equations (and many others appearing in the text) and without figures the evolution of ideas and their integration into a general theory, the title of which would coincide with the title of the dissertation. Thus, these pages can serve as a basis for writing a book (and then it would be good for Prof. Tsekov to trust an English-speaking editor for the details in the text), which would really crown a long work and a remarkable collection of ideas, equations, and interpretations, to which I have a long-standing recommendation - all these achievements would receive a significant resonance and recognition when they are successfully translated (in terms of validation!) into the language of computational materials science, for example by formulating an alternative (analogous) to the DFT approach. The sources of the main statements are missing. For example, the following, somewhat long, quote from there: “.. we explored another interpretation of quantum mechanics, where the particles remain points at any time as in classical mechanics. It is demonstrated that quantum mechanics is merely due to virtual force carriers

transmitting the fundamental interactions. The force carriers are waves / quasiparticles in the coordinate / momentum subspaces, respectively, and this is the reason for the wavy character of quantum mechanics, not the point particles themselves. This physical picture is consistent with the quantum field theory. " and this should be supported by a reference that is desirably authored by other than Prof. Tsekov authors. Another statement: "Presuming short-range interactions between the subsystem and the environment atoms, we derived a very important relation.", is not supported by a quote as well.

Another sentence "There are attempts to develop similar quantum idealizations, for instance in the Glauber-Sudarshan or Husimi representations, but they are less general and universal", in addition to linguistic smoothing, requires a more in-depth interpretation of what would mean "less universal", etc.

The two versions of the abstract, in Bulgarian and English, are with an identical content with the text of the dissertation but come without the articles. This probably brought relief to the reviewers as well.

The certificate of conformity presented by Prof. Tsekov shows that, where possible, the minimum national requirements for the scientific degree "Doctor of Science" in the scientific field 4. Natural sciences, mathematics and informatics, professional field 4.2. Chemical sciences are exceeded as well as the higher ones of FHF - SU.

I know Roumen Tsekov from the last courses of the then Faculty of Chemistry at Sofia University, we graduated from the same specialization. Then our paths parted to meet again around the program of the course in Non-Equilibrium Thermodynamics, which is still relevant today in FHF. Subsequently, I took on the difficult task of reviewing in 2011 the materials for his habilitation as a professor at the same faculty. I participated with an opinion in the academic jury for the defense of his doctoral student - Dr. Tatiana Peshkova. Thus, my long-term impressions can be summarized in a concise form as follows - Prof. Tsekov is a scientist of extraordinary size and his affiliation with the academic staff of Sofia University "St. Kliment Ohridski" is an incentive and a challenge for us, the other staff members, and the dissertation he presented is by no means the end of a successful career, but rather announces a forthcoming story of significant success.

Based on the above, I strongly recommend the scientific jury to award the degree of "Doctor of Science" to **Prof. Dr. Roumen Tsekov** in the professional field 4.2 Chemical Sciences and I expect that the forthcoming dissertation defense will only add new arguments to this persuasion.

August 26, 2021

Sofia

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