Review of the PhD. dissertation entitled "Studium nestabilních částic a prekurzorů biomolekul pomocí spektroskopických technik" by Martin Ferus

The PhD. dissertation by Martin Ferus is devoted to the spectroscopic characterization of molecules and radicals of astrochemical interest. The work is very comprehensive and gives a detailed experimental insight into the chemistry of those processes which could contribute to the formation of molecules of increasing complexity in the universe and eventually to the appearance of terrestrial life.

The dissertation starts with a concise, but highly informative introduction to the history of spectrometric detection of atoms and molecules in the space. This is followed with a chronological description of the main milestones of planetary evolution with a special emphasis on the chemical processes which could lead to the assembly of molecular materials. The next chapter summarizes the most important technical aspects and results of the measurements of unstable species present in the interstellar space, molecular clouds and comets. The successful application of this experimental approach is exemplified by three strong works published by the candidate in renowned international scientific journals (of which in two the candidate acts as first author and in the third as last and corresponding author). The first one concentrates on the dissociation of methane leading to the formation of radicals like $\cdot CH_3$, $\cdot CH_2$, $\cdot CH$ as well as that of atomic carbon. The novelty brought about by this investigation is that it discloses the conditions necessary to the successful detection of these radical species. The next example is the experimental modeling of the isomerization of HCN to HNC in molecular clouds and comets, where the candidate points at the significance of the reaction between HCN and atomic H at generation of HNC molecules. The third study published in this topic is devoted to the FT-IR spectroscopy of the dissociation products of CF_3Br and CF_3CFHCF_3 formed in a pulsed electrical discharge, which has conclusively shown that the emission spectra of these compounds are dominated by the $\cdot CF_2$ and $\cdot CF$ radicals.

The most extensive part of the dissertation is devoted to the discussion of the emergence of prebiotic molecules under early Earth conditions. In this chapter a special emphasis is given to the various extraterrestrial impact scenarios that was modeled by the candidate using laser plasma experiments. In this topic the candidate has two very strong publications as first author: the main findings thereof are presented in the dissertation in detail. The first one compares two plausible reaction routes for the production of CO_2 from CO under early Earth conditions, while the second one is devoted to a very topical scientific problem, dealing with the synthesis of nucleobases from formamide, recently suggested by Saladino et al. In addition, this part also discusses several catalytic scenarios for the emergence of prebiotic molecules with participation of TiO_2 catalysts.

The dissertation is closed with a succinct summary of the main findings of the scientific work reported.

In addition, the work contains a list of references (citing about 140 scientific papers).

I have one question. On page 17 line 4 the candidate mentions that among others, dissociation of formamide resulted in the formation of methanol. It would be very interesting to see a mechanistic proposal for the formation of methanol from formamide. What is the yield of methanol formation? I would greatly appreciate if the candidate could comment on this point.

Overall, the dissertation is very well elaborated both from formal and scientific sides and clearly testifies the excellent quality of the scientific research, which forms a solid basement for this dissertation. The main results of this PhD work were published in 15 scientific papers, (12 in high quality international journals and 3 in Czech journals). The candidate acts as first author on 4 papers published in international journals. In addition, on one further paper the candidate is listed as corresponding author. This is another proof of the high scientific value of the presented material and the independency of the candidate.

In summary, the dissertation work by Martin Ferus is very convincing and unambiguously shows the candidate's potential to carry out high-profile independent research. Therefore, in my opinion he is undoubtedly eligible to obtain the Doctor of Philosophy degree.

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