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Brno 27th March 2023

Review report of doctoral thesis of Mgr. Zdeněk Baďura (Palacký University Olomouc)

Doctoral programme:	**P1703 Fyzika / Physics**
Field of study:	**Aplikovaná Fyzika / Applied Physics**
Supervisor:	**doc. RNDr. Libor Machala, Ph.D.**
Name of the thesis:	**Eminent Role of Electron Paramagnetic Resonance for the Analysis of Spin Systems in Modern Low-Dimensional Materials**

The PhD thesis of **Mgr. Zdeněk Baďura** is dedicated to Electron Paramagnetic Resonance (EPR) spectroscopy of spin systems in modern low-dimensional materials. The work was done at department of experimental physics, Palacký University Olomouc in Czech Republic, under supervision of doc. RNDr. Libor Machala, Ph.D.

The presented dissertation work is written in English, divided into three chapters and with attached 3 original papers in appendixes. After a short introduction (3pages), the author describes basics of EPR theory and EPR instrumentation on 23pages in the first chapter, individual parts of the EPR instruments as well as the elemental theory (Zeeman splitting, spin-orbit and hyperfine interaction) is provided. The second chapter (73 pages) is dedicated to the experimental part of the work and contains two main sections. Section 2.1 Catalysis and Energy Storage introduces in a detail problematic of TiO2 based materials in photocatalytic processes in generation of H2 from water, followed by the experimental work of the candidate published in the papers attached as Appendixes A and B. Section 2.2 Magnetism and Magnetic Properties of Graphene Derivatives with Respect to the Potential Spintronic Applications review spintronic approaches highlighting graphene potential and how to circumvent its limitations in future spintronic devices with a focus on heteroatom doping. Following subsection is dedicated to the Nitrogen-doped graphene studies which was published in the paper attached as Appendix C and its supplementary material as Appendix D. The last chapter conclude the thesis by summarizing the individual chapters and outlining the current research of the candidate in material research.

Strengths:

- The work is well written and reads well with a personal view on the problematic.
- The number of 13 co-authored papers in per-reviewed journals is outstanding for PhD students and demonstrates his activity and commitment.
- Minimum remarks and mistakes.

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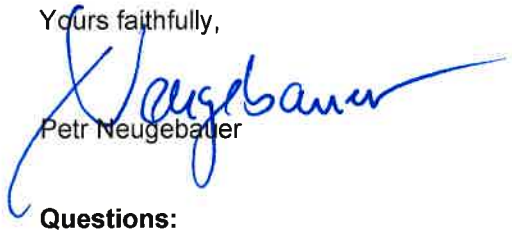
Weaknesses:

- References, particularly in the first chapter, some statements could be better supported by link to an original literature (Stern-Gerlach experiment, Eq.(1.3), etc). Often the PhD work is used by following students as a study material. Additionally, the list of provided references does not have unify style.
- The work could be better structured. It could be helpful to divide chapter two into additional chapters.

In my opinion, the reviewed thesis **fulfils** all requirements posed on theses aimed for obtaining PhD degree. This thesis **is** ready to be defended orally, in front of respective committee.

Yours faithfully,



Petr Neugebauer

Questions:

1. In the table 1.1 between the commercial EPR systems is listed 270 GHz system. However, the frequency is rather strictly set to 263 GHz. Why 263 GHz, can you explain?
2. Can you outline other chemical approaches to generate H2?
3. Can you elaborate on the "eminent role of EPR"? For example, how do you see EPR in 10years from now?

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