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It is my great honor to provide **review** of the **habilitation theses** of **Mgr. Piotr Błoński, Ph.D.** titled **"Atomic clusters and graphene: many faces of nanomagnetism"**.

The thesis summarizes author's achievements in the field of (nano)magnetism of various chemical species / systems, ranging from free and supported (homo- and hetero-atomic) dimers and small clusters of transition-metal atoms to functionalized graphenes. It is by no doubts an extremely attractive, truly frontier research with direct impact on our everyday lives – not only in availability of high-density data storage devices, but in all imaginable spintronic applications.

The thesis itself consist of about 130 pages of original text, the rest being a collection of reprints of 17 selected papers Dr. Błoński co-authored, topically grouped in three Appendixes. The original text starts with introductory section covering general magnetism and information storage, as well as intricacies of magnetism in modified / functionalized graphene. A minimalistic theoretical overview section follows, where the author briefly introduces concepts of the (solid state) density functional theory (DFT), especially their "workhorse" – noncollinear spin-polarized DFT. Chapter "Results" refers separately on essentially three (*de facto* five) distinct topics: structures and magnetic anisotropy energy (MAE) of free and graphene-supported transition-metal clusters; graphene on Ni(111) or Cu (111) supported Pt_{1-4}-clusters or transition-metal dimers, and finally the "Imprinting magnetism in graphene". Last chapter is dedicated to (again minimalistic) summary and outlook.

The first of the three aforementioned "Results" chapter sections starts with the discussion of results obtained in cooperation with prof. Hafner's group at the University of Vienna on magnetic anisotropy calculations of transition-metal dimers, and larger clusters afterwards.

Results were obtained using (at that time unprecedented computational approach) DFT with self-consistent inclusion of spin-orbit coupling, and have attracted a lot of attention and resulted in quite a few highly cited papers. A natural follow-up studies, described in the second section, trying to answer what is the impact of support on magnetic properties of transition-metal dimers and clusters, resulted in "theoretical design" of compound systems with huge MAE (IrCo dimer supported on graphene layer deposited on Cu(111)), however, these results are yet to be experimentally validated. The last section reports on the studies of nanomagnetism of functionalized graphenes, carried out at the Palacký University. This cooperation led to remarkable results on room temperature organic magnets, published in prestigious Nature Communication and ACS Nano papers. Last but not least, is there any other evidence needed to claim Dr. Błoński is an expert in the field, than his co-authorship of an excellent review titled "Emerging chemical strategies for imprinting magnetism in graphene and related 2D materials for spintronic and biomedical applications", published in Chemical Society Review (2018 impact factor of 40)?

To summarize, habilitation theses of Dr. Błoński certainly meets all necessary requirements, moreover, I could not practically identify any place for criticism. If I was force to some criticism, I would probably say that I was slightly missing an assessment of accuracy of the DFT results presented throughout the theses, with respect to *e.g.* (two-, four-component or other) relativistic approach based on a*b initio* wave function theory.

The quality the thesis along with the strong scientific record of Dr. Błoński (above 38 papers in high-quality peer-reviewed journals, H-index of 19, almost 1000 citations, etc.) clearly supports his habilitation, and recognizes him as a respected researcher in the field of nanomagnetism.

In Bratislava, 23rd of July

Doc. Mgr. Michal Pitoňák, PhD.