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Evaluation of the PhD Thesis

"Strong Interaction Corrections to the Weak Radiative B-Meson Decay at Order $\mathcal{O}(\alpha_s^2)$ with Exact Dependence on the c-Quark Mass"

by Abdur Rehman
presented at University of Warsaw

The presented thesis consists of an abstract, six sections, two appendices and a bibliography. The main achievement of the author presented in the thesis is the first evaluation of the charm quark mass dependence of the ultraviolet-counterterm diagrams contributing to NNLO QCD corrections ($K_{17}^{(2)}$ and $K_{27}^{(2)}$) to weak radiative B-meson branching ratio.

The thesis starts with Introduction, which follows in Section 2, where the current theoretical and experimental status of inclusive $\bar{B} \to X_s\gamma$ decay is presented and Section 3, where a detailed description of the methods used in the thesis can be found. The results obtained by the author, both new and some confirming previous calculations are presented in Section 4. The presentation of the methods used, encountered problems and their solutions is clear and well written. An Outlook and Conclusions show how the newly obtained results contribute to the field of calculations of the weak radiative B decays and how they can get useful in future.

The introduction, which span essentially up to Section 3 is somewhat to long for a PhD thesis, which is not a review article. The style is generally good. A few 'misprints' do not spoil the clarity of the presentation and thus will not be reported here. There are very few omissions of definitions or symbols in formulae, like lack of definition of z in Eq. (2.69), or rather well hidden definition in text a few pages before Eq.(2.69), or missing 'u' subscript in

Eq.(4.37). Thus the reader only rarely gets nervous trying to find or confirm the meaning of a given symbol. Hopefully the LATEX of the complicated formulae was generated automatically, otherwise the author should have written, what he did to ensure their correctness.

The author demonstrated that he has learned how to use modern methods of calculations of multi-loop integrals and how to use modern, publicly available software tools. He is aware of the complementarity of the various methods and uses this complementarity in his calculations. The presented numerical tests of the newly calculated parts are convincing and demonstrate that they are sound and trustworthy. His results/achievements are modest, yet, they give an important contribution to a quest for precise evaluation of the radiative B decays. They will serve as an ingredient in the future, more complete, calculations. He is a coauthor of one (published in PRL) article, where his results cross checked previously published results. Second publication, containing his main results presented in the thesis, is planned in near future. To my judgement it should have no problems during this process.

Taking into account all discussed above aspects of the presented thesis I declare that the thesis of Abdur Rehman meets all the requirements stated by Polish law and request to allow him to follow next steps in the PhD degree conferment procedure.

prof. dr hab. Henryk Czyż