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Report on the doctoral thesis entitled "Theoretical and observational aspects of physical processes in the field of compact objects" written by Katerina Klimovicova.

The thesis contains five chapters and eight articles published in refereed journals . Ms Klimovicova is a co-author of the attached papers. The main topic of the research revolves around the nature of kilohertz Quasi Periodic Oscillations (QPOs) observed in X-ray binaries. This is a very important question in astrophysics and the kilohertz QPOs have been puzzling astrophysicists for more than 20 years.

Chapter 1 contains a short introduction to the Low Mass X-ray Binaries (LMXBs) and their phenomenology. In chapter 2 the author presents models of QPOs which have been proposed in literature. Chapter 3 and 4 contain original scientific results that are an extension of the work presented in the article journals appended to the thesis. Finally, in chapter 5 the author presents a short summary of the work.

The papers appended to the thesis represent the research work of the author with collaborators and with the advisor. All articles are signed by many authors. Ms Klimovicova is the first author of one the papers, and the second author of five articles. In the remaining three articles her name is at a later position. Note that two articles listed in the description:

- Goluchva et al. ,.: Mass of the active galactic nucleus black hole XMMUJ134736.6+173403. Astronomy& Astrophysics, 622, id.L8, 2019, and
- Török, G.; Goluchová, K.; Šrámková, E.; Urbanec, M.; Straub, O.: Timescale of twin-peak quasi-periodic oscillations and mass of accreting neutron stars. Accepted for publication in MNRAS

are not appended to the thesis. On the other hand the author appended the paper that is not listed on pages 67-68 of the thesis:

- Stuchlik et al, Test of the Resonant Switch Model by Fitting the Data of Twin-Peak HF QPOs in the Atoll Source 4U 1636-53, Acta Astronomica, 2014, Volume 64, no 1, p. 45-64.

Thus the list effectively contains ten papers, however the reader must look for two somewhere else. Each paper is an important voice in the discussion on the nature of kilohertz QPOs.

Nevertheless the list shows that Ms Klimovicova played an important role – either lead or second author – in a significant number of papers. The papers have been published in top journals in the field.

The thesis is very short and compact. In general I would expect a little more from a thesis: the introduction, presented chapters 1 and 2, could be more comprehensive to show the general knowledge in the field of the author.

In chapter 3 the author collects the data from multiple observational campaign and comprehensively tests many models with these data. The work presented in this chapter leaves a feeling of being unfinished. The results are very important and interesting but I would like to see a discussion of the results. The author is just one step from discussing which model better describes the reality and which is worse. At this point the reader must do it alone. It would be very good to include also discussion on differences between models – why the mass of the compact object is different as inferred within different models. How does the mass compare to the values determined by other methods e.g. via the mass function of the binary.

Chapter 4 is devoted to the oscillating torus model of QPOs. The author calculates two models of the torri oscillations and shows their power spectra as well as the series of images of torri configurations as seen by an observer if the images were to be resolved. In my opinion this part also lacks discussion – what would be the observations that this can be compared to? In the second part of the chapter the author presents a series of calculations of the iron line profiles for these models. What is presented are the static – I think time averaged lines. Do we expect the line profiles to change and oscillate as the QPOs? Are these line profiles different from of non oscillating torri? A discussion of these question would make the thesis fuller and much more useful. In the current state it is essentially a step in the right direction but not a fully finished calculation. The author indicates that this chapter shows the direction of the future work which leaves the reader with the hope to see the full discussion in the forthcoming papers of the thesis author

The thesis contains a large bibliography with 126 references. This demonstrates that the author is an expert in the field and can navigate the subject . The choice of the references is correct and there are also references to older, original papers.

A minor remark is that the thesis would benefit if the author included a glossary of terms and definition of symbols. In some cases one has to read carefully and the definition of a symbol appears half a page later after it is introduced. A glossary of terms and a list of symbols would make the reading much easier.

In summary the thesis contains valuable scientific results the push forward the understanding of kHz QPOs. Additionally, the author has included several journal articles in which she is the lead or main author. Despite the critical remarks listed above I consider the work very valuable and interesting, and a significant step towards understanding the nature of kHz QPOs. Therefore I conclude that the thesis fulfills the requirements for the degree of doctor of philosophy.

Prof Tomasz Bulik