

**I. IDENTIFIKAČNÍ ÚDAJE**

<b>Název práce:</b>	<b>Vliv vysokorychlostní komponenty temné hmoty na citlivost sub-eV detektorů</b>
<b>Jméno autora:</b>	<b>Adam Červenka</b>
<b>Typ práce:</b>	bakalářská práce
<b>Fakulta:</b>	Fakulta jaderná a fyzikálně inženýrská (FJFI)
<b>Katedra:</b>	Katedra fyziky
<b>Oponent práce:</b>	Guillermo Contreras
<b>Pracoviště oponenta práce:</b>	KF-FJFI-ČVUT

**II. HODNOCENÍ JEDNOTLIVÝCH KRITÉRIÍ**

<b>Zadání</b>	<b>náročnější</b>
<i>Hodnocení náročnosti zadání závěrečné práce.</i>	
The thesis deals with dark matter, a topic that is not at all covered during the B. Sc. studies. This means that the amount of extra knowledge to be assembled just to be able to start with the work is a lot larger than for other topics better covered in the B. Sc. program.	

<b>Splnění zadání</b>	<b>splněno</b>
<i>Posuďte, zda předložená závěrečná práce splňuje zadání. V komentáři případně uveďte body zadání, které nebyly zcela splněny, nebo zda je práce oproti zadání rozšířena. Nebylo-li zadání zcela splněno, pokuste se posoudit závažnost, dopady a případně i příčiny jednotlivých nedostatků.</i>	
All the topics mentioned in the protocol of the thesis are covered. Furthermore, to make the connection between the proposal and the realisation, these topics are correlated with the structure of the thesis.	

<b>Zvolený postup řešení</b>	<b>vhodný</b>
<i>Posuďte, zda student zvolil správný postup nebo metody řešení.</i>	
There are two distinct parts in the thesis (as is normal in a B. Sc. thesis). First the review of relevant material. This is well achieved and in several different levels: review of the historical development of the concept of dark matter, review of the galaxy and its components, review of acceleration mechanisms and review of potential detecting methods. The second contribution of the thesis is the computation of the increase of velocity for some of the dark matter particles thanks to sling-shot acceleration by gravity. Here, the proposed method of numerical simulation is certainly appropriate.	

<b>Odborná úroveň</b>	<b>výborná</b>
<i>Posuďte úroveň odbornosti závěrečné práce, využití znalostí získaných studiem a z odborné literatury, využití podkladů a dat získaných z praxe.</i>	
The level is quite high, especially if one considers that none of the material is discussed in the B. Sc. program. The text is clearly organised. The key issues have been summarised in a concise and transparent way. The idea of the author was indeed correct and some of the dark matter particles get a substantial acceleration by gravity.	

<b>Formální a jazyková úroveň</b>	<b>průměrná</b>
<i>Posuďte správnost používání formálních zápisů obsažených v práci. Posuďte typografickou a jazykovou stránku.</i>	
I could read the text without problems, which considering that I am not a native speaker, speaks well of the clarity of the text. Nonetheless, I have the impression that several sentences felt like English in Czech. This did not affect the clarity of the text, but I wonder if a native speaker would have remarked on this. There were some inconsistencies on the relative positioning of citations and periods. Some figures in the text were not referenced at all (if I am not mistaken: 1.1, 1.2, 2.1, 2.2, 3.1 and 5.4 fall in this category). The use of references	

can be improved. This for me is the main issue. Sometimes the reference appeared quite late, and it was not clear how much of the previous text was covered by the reference. Sometimes it was in a strange place. Sometimes (e.g. in the 2-page introduction) no references were used. This is a relatively small issue: in no way the author gives the impression of presenting work from someone else as his own work, so this is fine ; but this must be improved for the M. Sc. thesis.

**Výběr zdrojů, korektnost citací**

**výborné**

*Vyjádřete se k aktivitě studenta při získávání a využívání studijních materiálů k řešení závěrečné práce. Charakterizujte výběr pramenů. Posuďte, zda student využil všechny relevantní zdroje. Ověřte, zda jsou všechny převzaté prvky řádně odlišeny od vlastních výsledků a úvah, zda nedošlo k porušení citační etiky a zda jsou bibliografické citace úplné a v souladu s citačními zvyklostmi a normami.*

The list of reference is quite long for a B. Sc., but it is justified by the fact that all the material is "new" from the point of view of the program, so it cannot be assumed as known. I found interesting the variation on the type of references. Some of them linking to nice outreach introductions to specific topics, some key papers in the field, some reviews. Except for their placement (mentioned in the previous block) I was happily impressed by the reference list.

**Další komentáře a hodnocení**

*Vyjádřete se k úrovni dosažených hlavních výsledků závěrečné práce, např. k úrovni teoretických výsledků, nebo k úrovni a funkčnosti technického nebo programového vytvořeného řešení, publikačním výstupům, experimentální zručnosti apod.*

I want to emphasize again that I really value that the student, and his supervisor, took the risk of exploring an idea of the student, and made it work within the quite constrained environment of a B. Sc. thesis (the students have tons of lectures, so little time to embark in a completely new direction). Furthermore, the intuition of the student was correct and the expected effect was found, which is quite nice.

**III. CELKOVÉ HODNOCENÍ, OTÁZKY K OBHAJOBĚ, NÁVRH KLASIFIKACE**

*Shrňte aspekty závěrečné práce, které nejvíce ovlivnily Vaše celkové hodnocení. Uveďte případné otázky, které by měl student zodpovědět při obhajobě závěrečné práce před komisí.*

The main aspect of the thesis is that the key idea is an original proposal from the student. In my opinion, this is excellent. In general, I liked the text (see the small comments above). I have a few questions for the student:

- 1.- Can you give more details on the technical aspect of the simulation? How long did it take? In which language did you program it? Where did you run it and how many resources were needed?
- 2.- Probably connected with the previous question: can you motivate the values of the parameters in Table 3.3? In particular, the time (just a few days), the cube size (quite small in a galactic, even in a solar system, scale) and the number of particles in the simulation.
- 3.- In p.36 you list 6 potential improvements. I like this, so I would like you to comment on the following: Which of them would have the largest numerical impact and why? (I am interested just on what your intuition tells you, so no need of extra simulations or anything, just what you think about this)
- 4.- You showed that some particles are accelerated, and you claim that this could make it easier to detect them. Conversely, one could argue that some of them are de-accelerated and would make it more difficult to observe them, which could have an impact on existing limits (they would be too optimist). Would you agree with this statement? if yes, what is the fraction of de-accelerated particles and how much were they de-accelerated?

Předloženou závěrečnou práci hodnotím klasifikačním stupněm **A - výborně**.

Datum: Klepněte sem a zadejte datum.  
13.08.2024

Podpis:

