

# FYS3520 - Problem set 7

Spring term 2017

Version 0:

This problem set is now finished yet, however I wanted to provide it to you already as early as possible. I will have to adopt the problem set and the content of the in-class discussion according to how far we get in the lecture on Wednesday after Easter. But you may use this as a guideline to interesting problems.

Hand-in deadline [as always, voluntary]: 25, April; digital only (!)

## Problem 1 – in class

- Describe the fission process: Explanations on what and why it happens, “reaction products” (how do we call these?), time scales, energy distribution, ...?
- On the applications side: Simple explanation on how nuclear reactors work; What is the significance of fission in astrophysics?
- If we have enough time/you are interested I can talk about: How do nuclear bombs work? What types are there? How can one detect nuclear weapons tests (if your are interested, see eg. <http://ctbto.org/>)
- Want to know the effect of a nuclear bomb on your home town? There’s an app for that: <https://nuclearsecrecy.com/nukemap/>. There is plenty more information, books, website on such things; I can give you more information if you interested

## Problem 2 Aspects of nuclear fission

- Estimate the neutron energy needed to produce fission of  $^{208}\text{Pb}$ . Is it likely that such neutrons would be released in the fission, making possible a self-sustaining reaction?  
Hint: You may look at <https://www-nds.iaea.org/exfor/endl.htm>; I can help you in the problem session to retrieve information from there. A nice graphical interface is given by JANIS <http://www.oecd-nea.org/janis/>.
- Use Figure 13.7 in Krane to estimate the fraction of neutron-induced fissions of  $^{235}\text{U}$  that emit no prompt neutrons.
- Discuss the formation of  $^{244}\text{Pu}$  in the core of a reactor operating with enriched uranium as a fuel. (As you have not had a formal introduction on nuclear reactions yet, you may do this on a qualitative level, not regarding the cross-section for the processes.) From what other context might you know  $^{244}\text{Pu}$ ?