Phys 231 2021

Lecture 41

Final Exam: Weds May 19 10am - noon

* Done remotely
* Electronic pdf version of exam will be emailed
* Will proctor via Zoom
* Submit to D2L or email to me.
* Can use: text / notes
* Cannot use: any consultation with another person or interface to another person.
* Study 2020 Final exam.

  All class exams

  HW problems

  Class exercises / quizzes.

HW 14 : Will be returned electronically later on Friday.

Evaluations

HW 15: (20pts extra credit to HW total)

- turn in by Thursday, May 20

Heisenberg + German uranium project

Werner Heisenberg - German physicist born 1901

- Worked on formalism for quantum theory "matrix mechanics" that allowed for quantum theory to be extended beyond wavefunctions
- could be applied to spin-½

  * spin up $\sim$ $\begin{pmatrix}1\\0\end{pmatrix}$ and $(1\ 0)$
  * spin down $\sim$ $\begin{pmatrix}0\\1\end{pmatrix}$ and $(0\ 1)$
  * z-component of spin $\hat{S}_z = \frac{\hbar}{2}\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}$
  * expection value for spin up

$$\langle S_z\rangle = \frac{\hbar}{2}(1\ 0)\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}\begin{pmatrix}1\\0\end{pmatrix} = \frac{\hbar}{2}(1\ 0)\begin{pmatrix}1\\0\end{pmatrix} = \frac{\hbar}{2} \quad \text{etc,...}$$

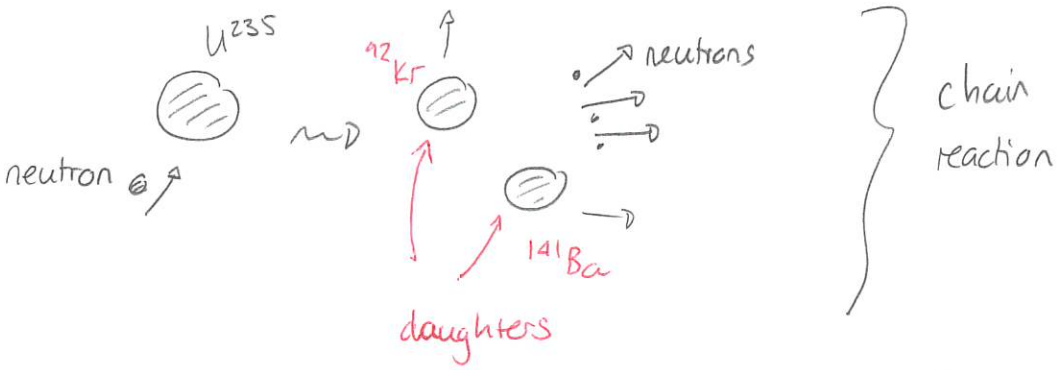
- Nobel prize 1932
- Heisenberg uncertainty relation
- One of founders of quantum theory.
- Kaiser Wilhelm Institute of Physics - MPI

Germany in 1930s / 1940s

- Nazis assumed power in 1933
- World War II 1939-1945
- Nazis were interested in possibility of nuclear weapons.

Nuclear weapons (fission)

- used energy released when Uranium splits



total mass less than before

$E=mc^2 \Rightarrow$ energy released

- first discoverd in 1934 Jolict-Curie / Fermi
- details of this confirmed in 1939.
- Szilard suggested theoretical possibility in 1934
- US - Einstein warns president of the possibility 1939
  - initially small investigations
  - Manhatten Project 1942
- UK - Realized than amount of U^{235} needed was obtainable.