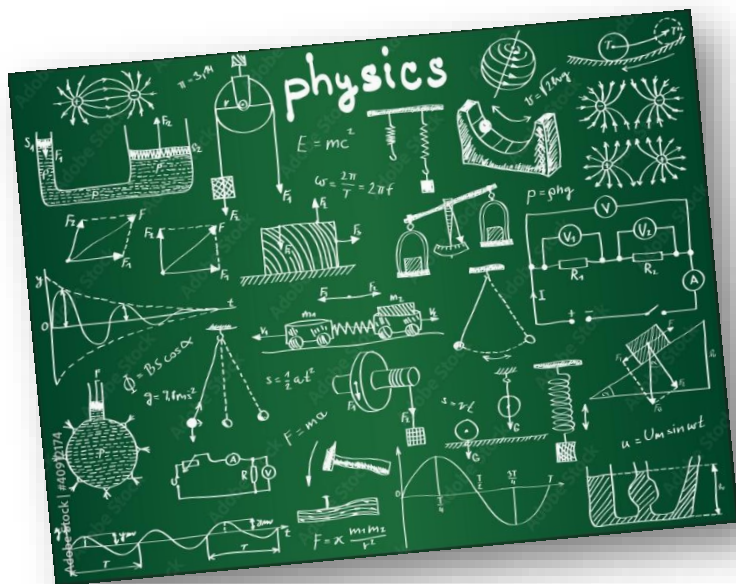
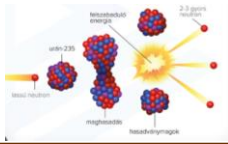


# Physics is fun

# Welcome to



# class



# Physics is fun



## Who am I?

**Dr. Beáta Jarosievitz PhD.**

- College professor
- Educational advisor (Physics, Computing)
- Science team leader (in TBG since 2 years)
- GIREP representative in Hungary (International Research Group on Physics Teaching)

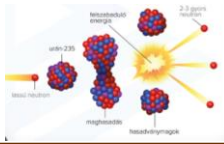
## Research activity

- Use of ICT and multimedia in education
- Determination of radioactivity of artificial origin in aerosols
- Gamma-Spectrometry of Extended Sources for Analysing Environmental Samples

## Aim

- to increase the popularity of „Physics“
- to enhance students' motivation to science



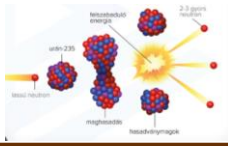


# Physics is fun



- 1. Welcome**
- 2. Introduction**
- 3. Properties of atomic nuclei**
- 4. Radioactive nuclei, radioactive radiation**
- 5. Fission**
- 6. Fusion**
- 7. Chain reaction**
- 8. Use of fission and fusion**

*Table of Content*



# Physics is fun



## 2. Introduction

### Well known problems

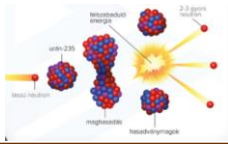
- the **traditional physics** classes **do not attracts our students'** focus to the lectures
- the popularity of „Physics, Science" has decreased worldwide
- students have at least one digital device but do not use them for study

*(Jarosievitz, 2009)*

### Solutions

**Make fun classes using different methods!**





# Physics is fun



## 2. Introduction – used methods in this class

for teachers

### Lecture Method

- use for describing the structure of atoms, the concept of A and Z

### Cooperative method

- use of group-work activity based on gamification

### Inquiry-based learning

- we will analysing and try interpret some real experiments' data

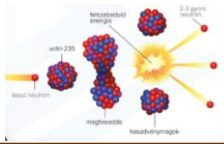
Hypothesis

Observation

Analyzing

Interpreting

Conclusion



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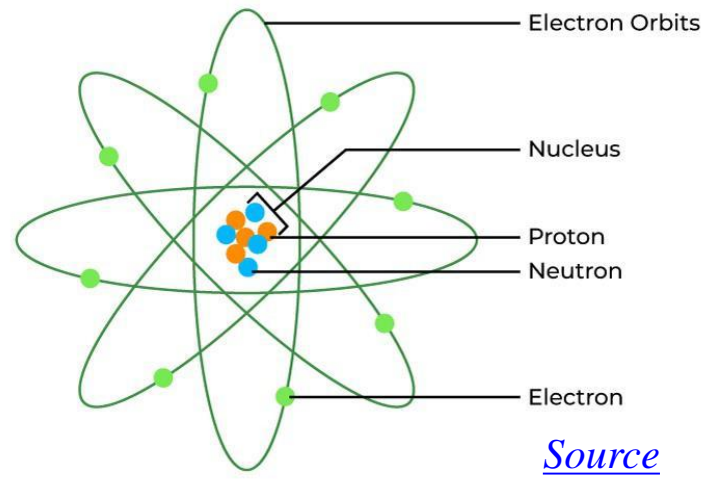
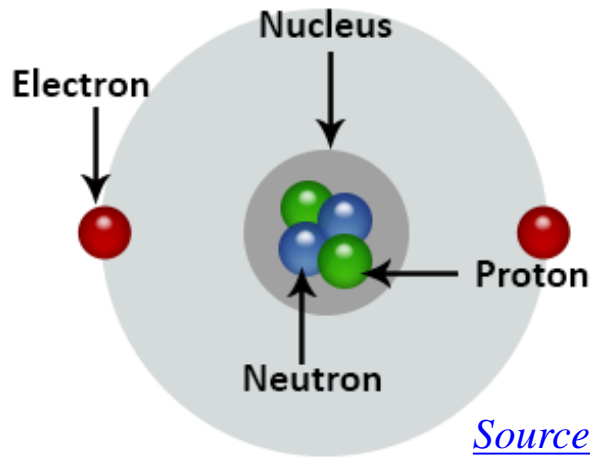


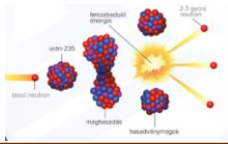
## 3. Properties of atomic nuclei - review

### Composition of atom:

- electrons
  - Proton
  - Neutron
- } **nucleons**

| mass                        | electric charged         |
|-----------------------------|--------------------------|
| $1,67265 \cdot 10^{-27}$ kg | +e (positively charged)  |
| $1,67495 \cdot 10^{-27}$ kg | 0 (electrically neutral) |

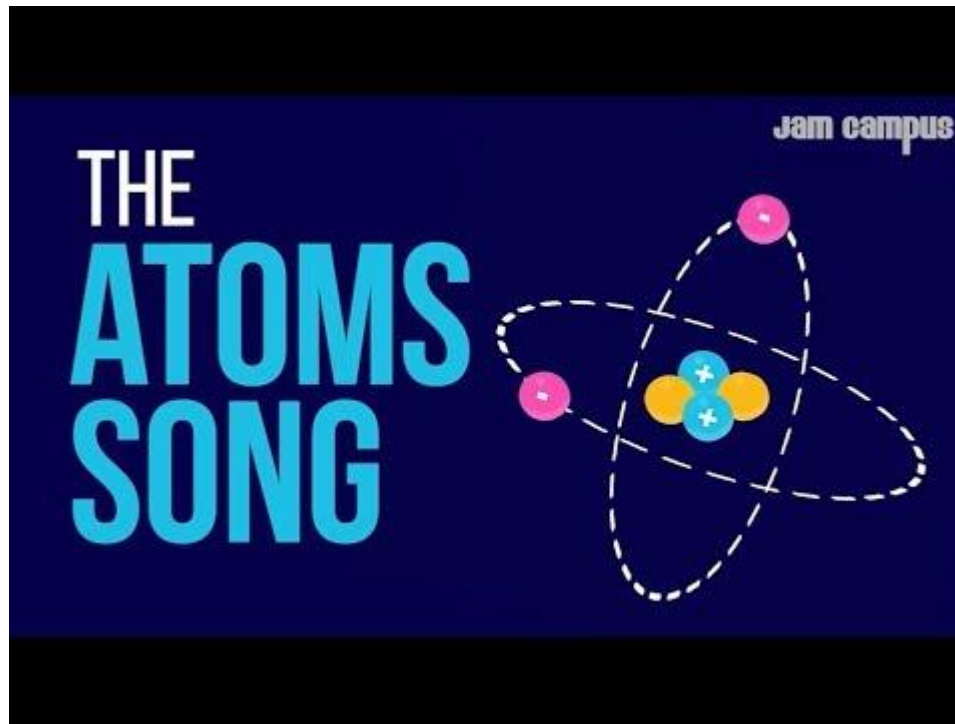




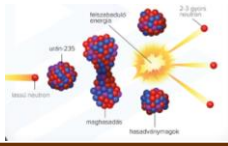
# Physics is fun



## 3. Properties of atomic nuclei - review



[Source](#)



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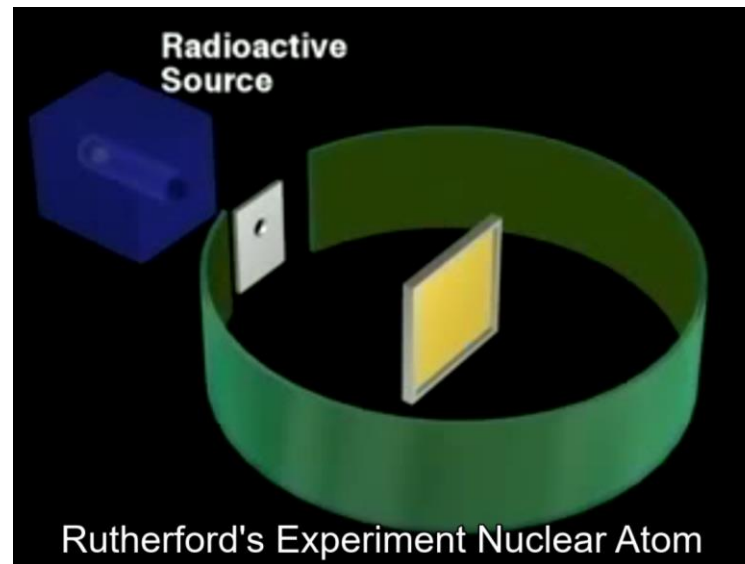


## 3. Properties of atomic nuclei - review

Mass number = total number of protons and neutrons  $A = Z + N$

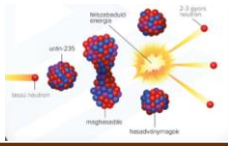
Atomic Number = number of electrons in orbit around the nucleus  $Z$   
equals the number of protons in the nucleus.

**Atomic Nucleus** was discovered by Rutherford (1911)



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## 3. Properties of atomic nuclei - review

**Nucleus** is located in the centre of the atom and contains protons and neutrons.

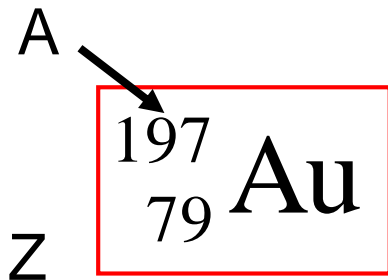
The average density of atomic nucleus

$$2,5 \times 10^{17} \text{ kg/m}^3$$

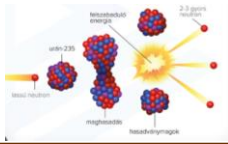
The radius of atomic nucleus is

$$R = r_0 \sqrt[3]{A}, \text{ where } r_0 = 1.2 \cdot 10^{-15} \text{ m}$$

**Subatomic particles** are the particles that make up an atom are: electrons, protons, neutrons



$$N = A - Z = 197 - 79 = 118$$



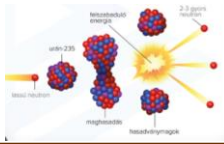
# Physics is fun



## 3. Properties of atomic nuclei - review

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[Source](#)



# Physics is fun



## 4. Radioactive nuclei, radioactive radiation

**Antoine Henri Becquerel** (15 December 1852 – 25 August 1908)

Nobel laureate French physicist, **discovered the radioactivity** (1896)

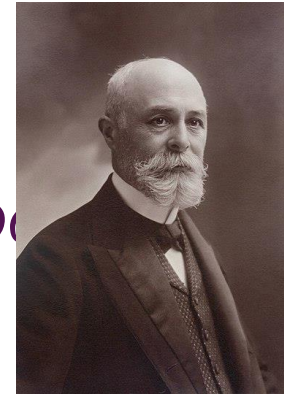
See more information [here](#)

### Definition

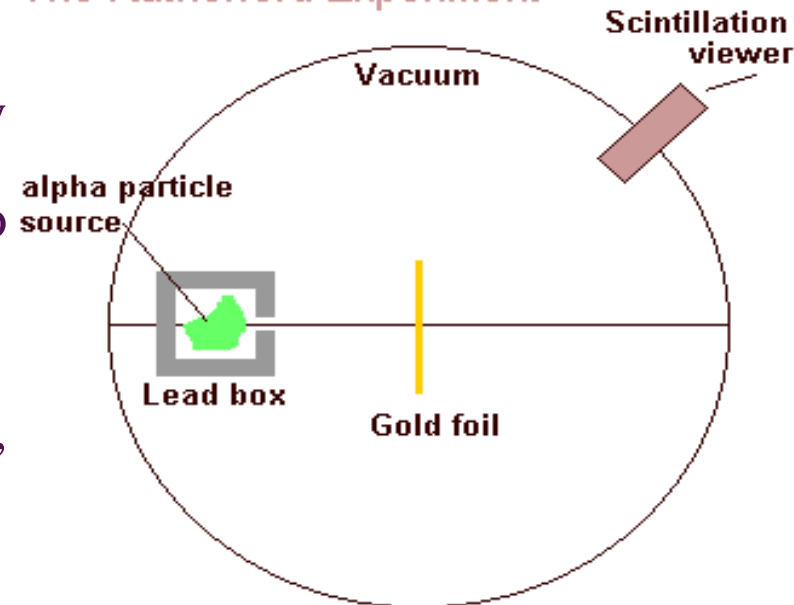
Many atomic nuclei emit particles without any external effect and transform themselves into other nuclei.

These unstable nuclei are called radioactive, and the process is called radioactive decay.

The stream of the emitted particles form the radioactive radiation.

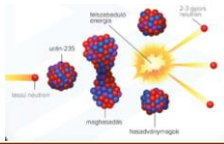


The Rutherford Experiment



©1999 Science Joy Wagon



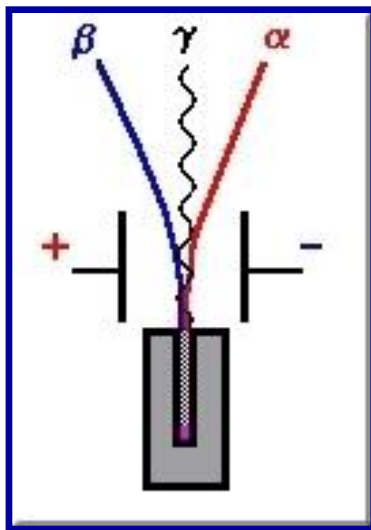
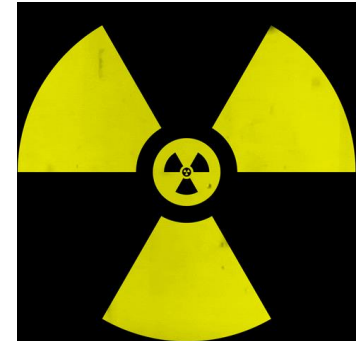


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## 4. Radioactive nuclei, radioactive radiation

Types of radioactive decay:



**United Nuclear**



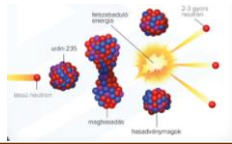
paper



aluminium



lead



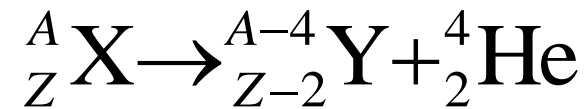
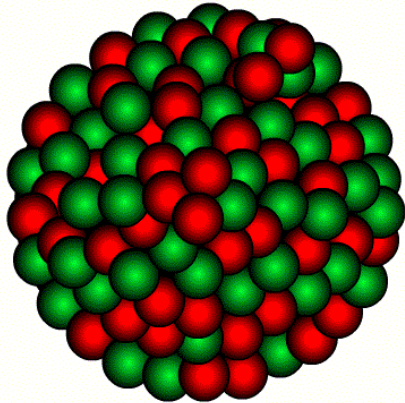
## 4. Radioactive nuclei, radioactive radiation

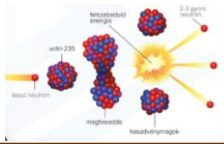
### Alpha-decay

#### Alpha decay

 atomic number:  $Z$

 +  mass number :  $A$





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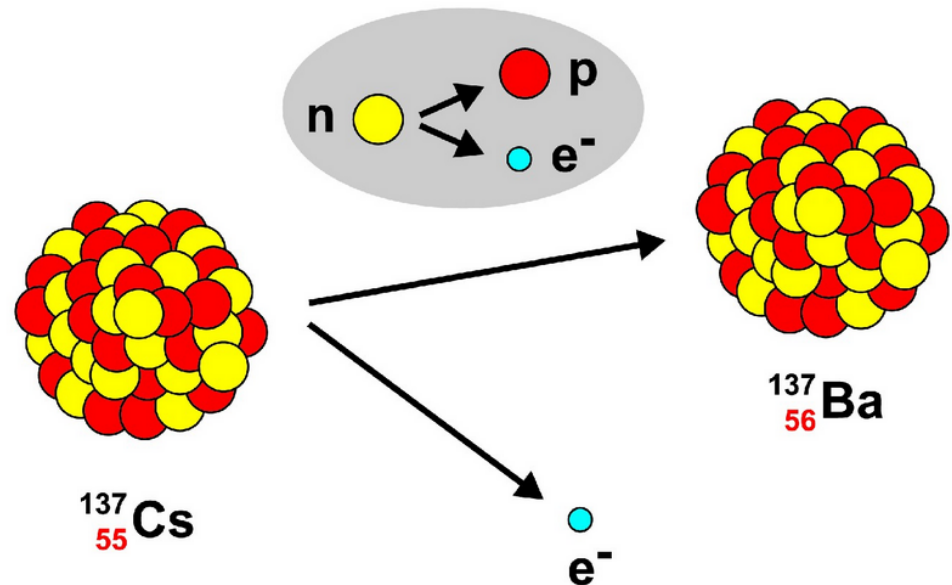
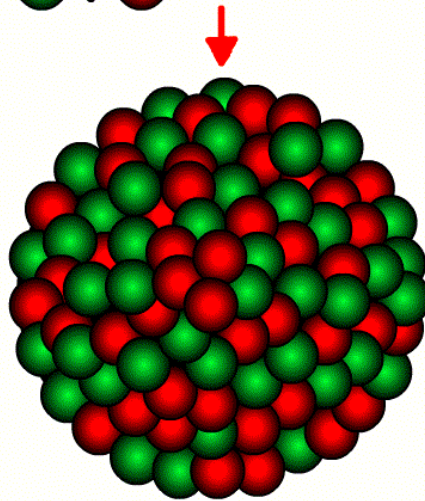
## 4. Radioactive nuclei, radioactive radiation

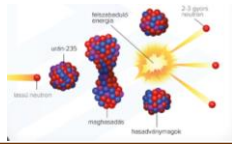
### Negative beta-decay

Negative beta-decay

● atomic number : Z

● + ● mass number : A





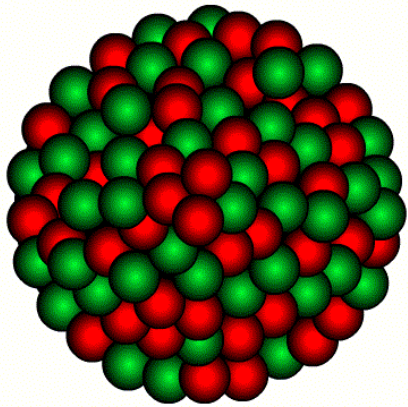
## 4. Radioactive nuclei, radioactive radiation

### Gamma decay

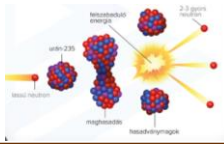
#### Gamma decay

 atomic number :  $Z$

 +  mass number :  $A$



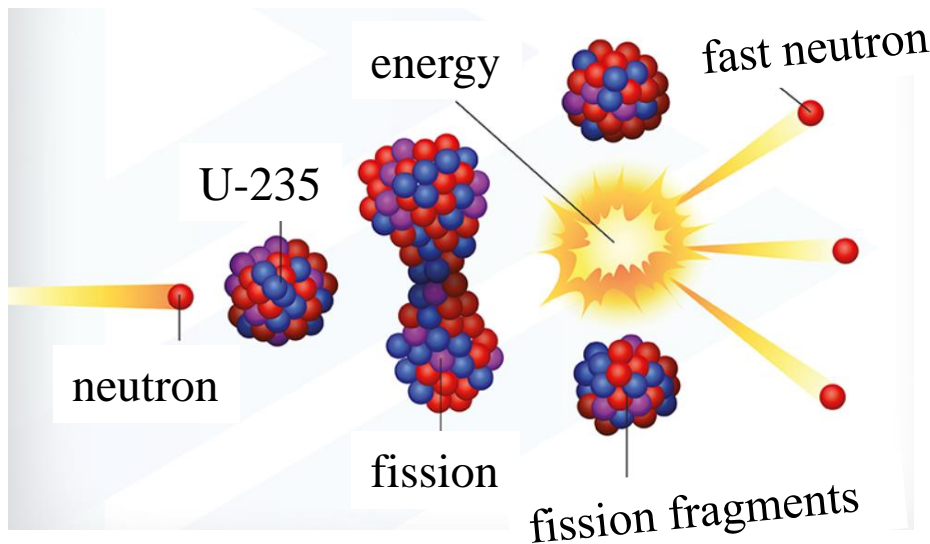
$$h \cdot \nu = E'(A; Z) - E(A; Z)$$



# Physics is fun

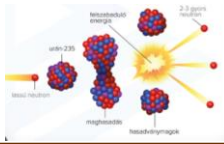


## 5. Fission (Spontaneous fission)



[\*Source\*](#)





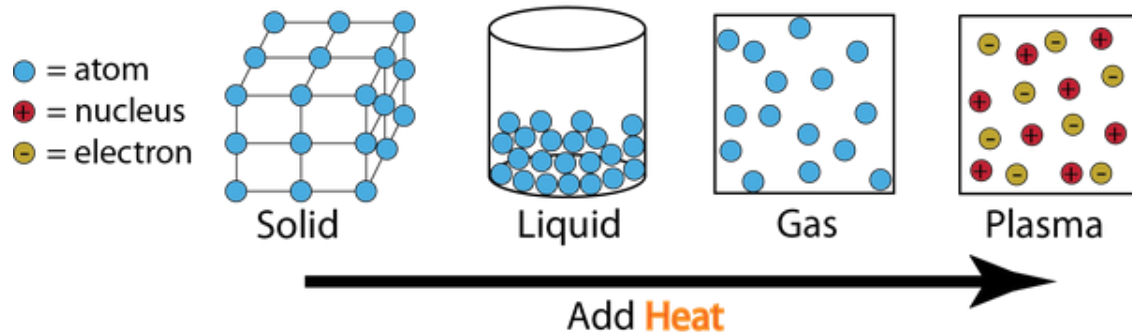
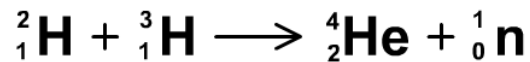
# Physics is fun

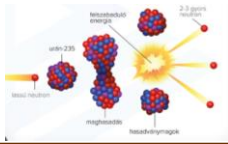


## 6. Fusion

- In a fusion reaction, **two light nuclei merge to form a single heavier nucleus, and liberate energy.**

### Nuclear Fusion





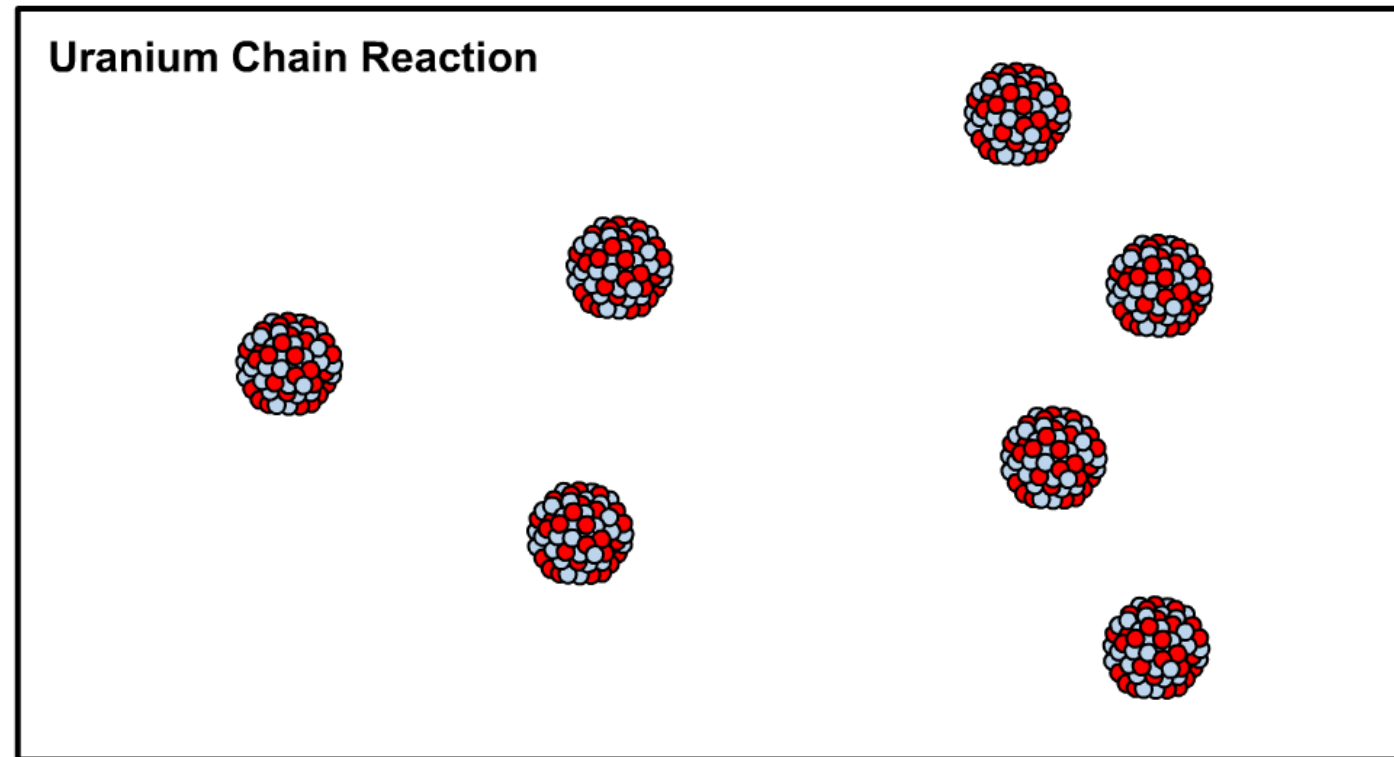
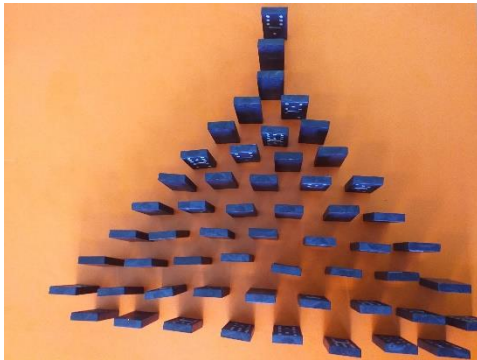
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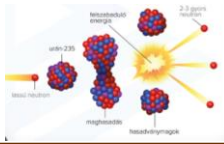


## 7. Chain reaction

## What is a Chain Reaction?

### 1<sup>st</sup> experiment





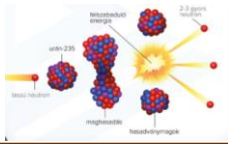
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## 7. Chain reaction with students

2<sup>nd</sup> experiment



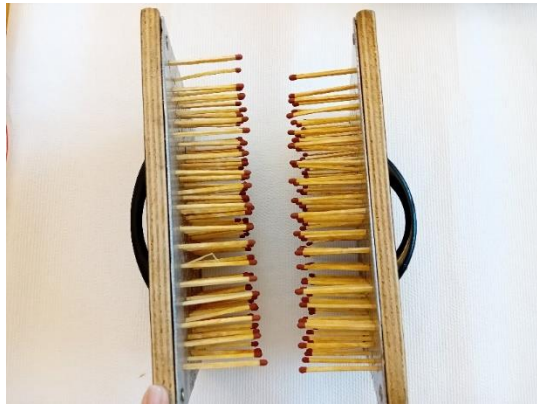


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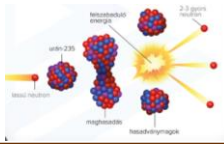


## 7. Chain reaction

### 3<sup>rd</sup> experiment



is a sequence of reactions where a reactive product or by-product causes additional reactions to take place.



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## 8. Use of fission and fusion

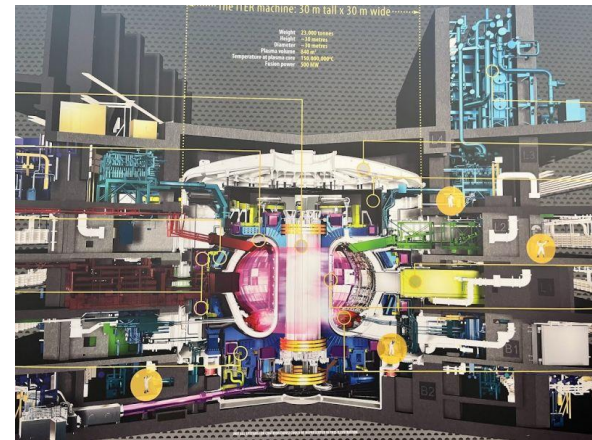
Paks Nuclear Power Plant (Hungary)

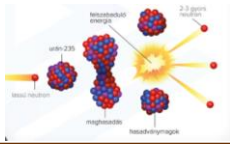


ITER (Cadarache, France)



The ITER experimental device (in construction)





# Physics is fun



## Conclusion

**Yes, it is true: Physics Can Be Fun**



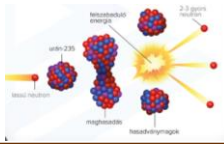


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## References

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- Pearson. Suzaan Le Roux (2013): Mobile Learning as a paradigmatic mechanism to facilitate technology-based learning in a development country, Cape Peninsula Univ. of Technology
- Mazur, E. (2014). *Peer Instruction: Pearson New International Edition: A User's Manual*.
- The atomic song: <https://www.youtube.com/watch?v=GLp9ihOYjjM>
- Periodic table: [https://www.youtube.com/watch?v=rz4Dd1I\\_fX0](https://www.youtube.com/watch?v=rz4Dd1I_fX0)
- Nuclear chain reaction explained in 60 seconds  
<https://www.youtube.com/watch?v=hToe4gqTu98>
- The experint video: [https://www.youtube.com/watch?v=vjqIJW\\_Qr3c](https://www.youtube.com/watch?v=vjqIJW_Qr3c)
- Chain reaction: <https://www.youtube.com/watch?v=THWYETEogog>



# Physics is fun



„The future cannot be predicted,  
but futures can be invented”.

*Dennis Gabor*

**DENNIS GABOR: Nobel prize winner for holography: 1971**

**Thank you for your attention!**

