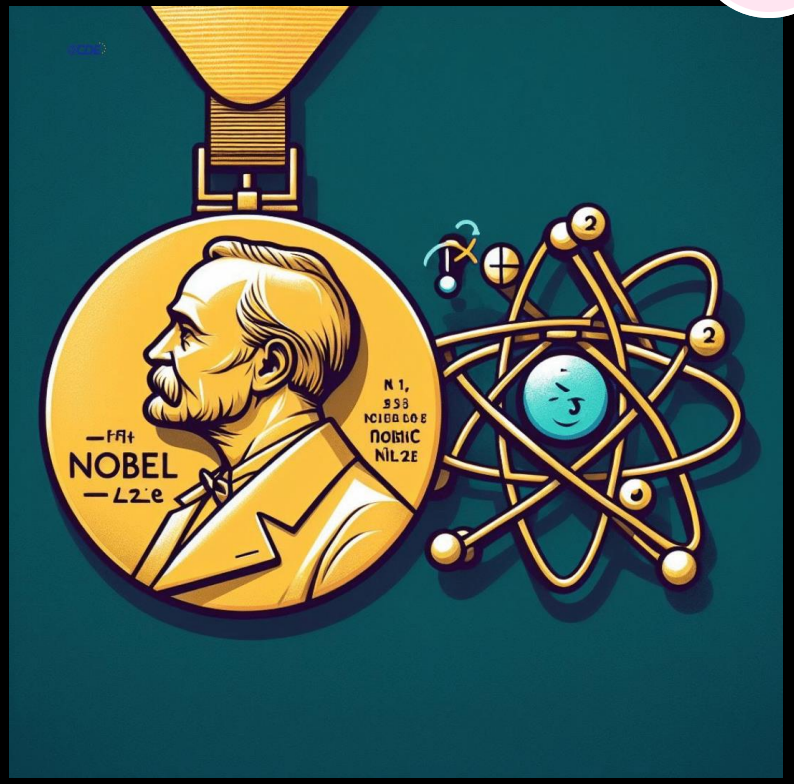


NOBEL PRIZE IN PHYSICS 2023

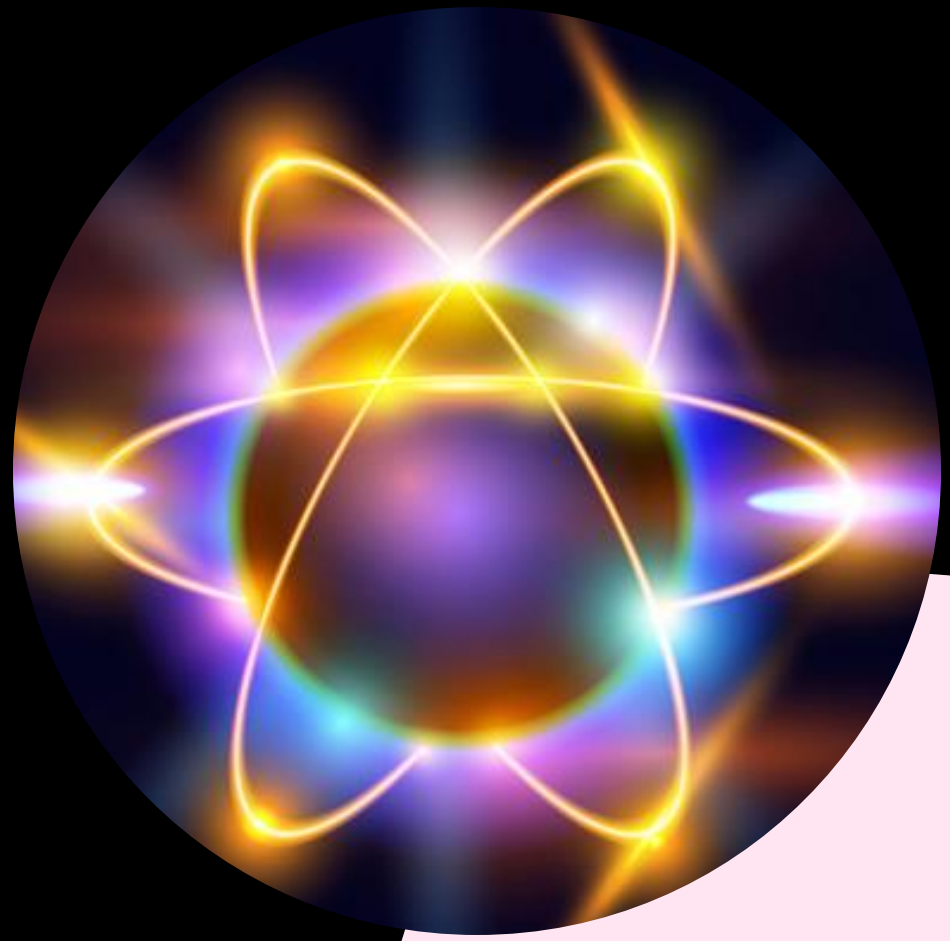
MADE BY BRUNO LUCREZIA, CHINNI GIULIA, ANKAMAH SIMONA, CURSIO GIOVANNI, MUSTAFA JASCIAR

Anne L'Huillier

Anne L’Huillier is one of the few women to receive the Nobel Prize in Physics. She believes female role models are important to inspire young girls to study science. One of her greatest inspirations is Marie Curie. She explains that scientific research is full of difficulties and failures, so scientists need: resilience, determination and self-confidence. She also highlights the importance of education and teachers, because research and teaching help inspire future generations and spread passion for science.

Anne L'Huillier

Anne L’Huillier studies the interaction between electrons and laser light. Her Nobel Prize research focused on generating extremely short light pulses called attosecond pulses. Using very intense lasers, scientists can create harmonics that combine into ultrafast light pulses. These pulses work like an “ultrafast camera” able to observe the movement of electrons inside atoms and molecules. This technology could improve the study of: chemical reactions; photosynthesis; solar cells. Understanding electron motion may help scientists better control these processes.



Nobel Prize in Physics 2023

The 2023 prize was awarded to Pierre Agostini, Ferenc Krausz, and Anne L'Huillier. They developed experimental methods that generate attosecond pulses of light. These pulses allow scientists to study the rapid movements of electrons within atoms and molecules-processes so fast they were once thought impossible to observe.

- Anne L'Huillier: Discovered the light overtones from laser-gas interaction.
- Agostini & Krausz: Developed techniques to isolate pulses as short as 250 attoseconds.

Nobel Prize in Physics 2023

An attosecond is a quintillionth of a second. To put it in perspective, there are as many attoseconds in one second as there have been seconds since the universe began.

1 attosecond = 10^18 seconds

While still in the fundamental research phase, attosecond physics promises breakthroughs in:

Electronics: Creating switches millions of times faster than current silicon technology.

Medicine: New diagnostic tools based on identifying molecular changes via light pulses.

What is a particle accelerator?

A particle accelerator is a machine that speeds up charged particles (like electrons) to very high energies.

The particles are pushed using electric fields and guided by magnetic fields.

At high speeds, particles can be used to study matter at the atomic scale.

Why are accelerators important?

- They allow scientists to explore very small structures that cannot be seen with microscopes.
- High-energy particles can produce radiation or collide with materials.
- This helps in: physics research, medical imaging and cancer therapy, material science , fundamental research on matter and energy

X Rays

X-rays are a form of electromagnetic radiation with very short wavelengths.

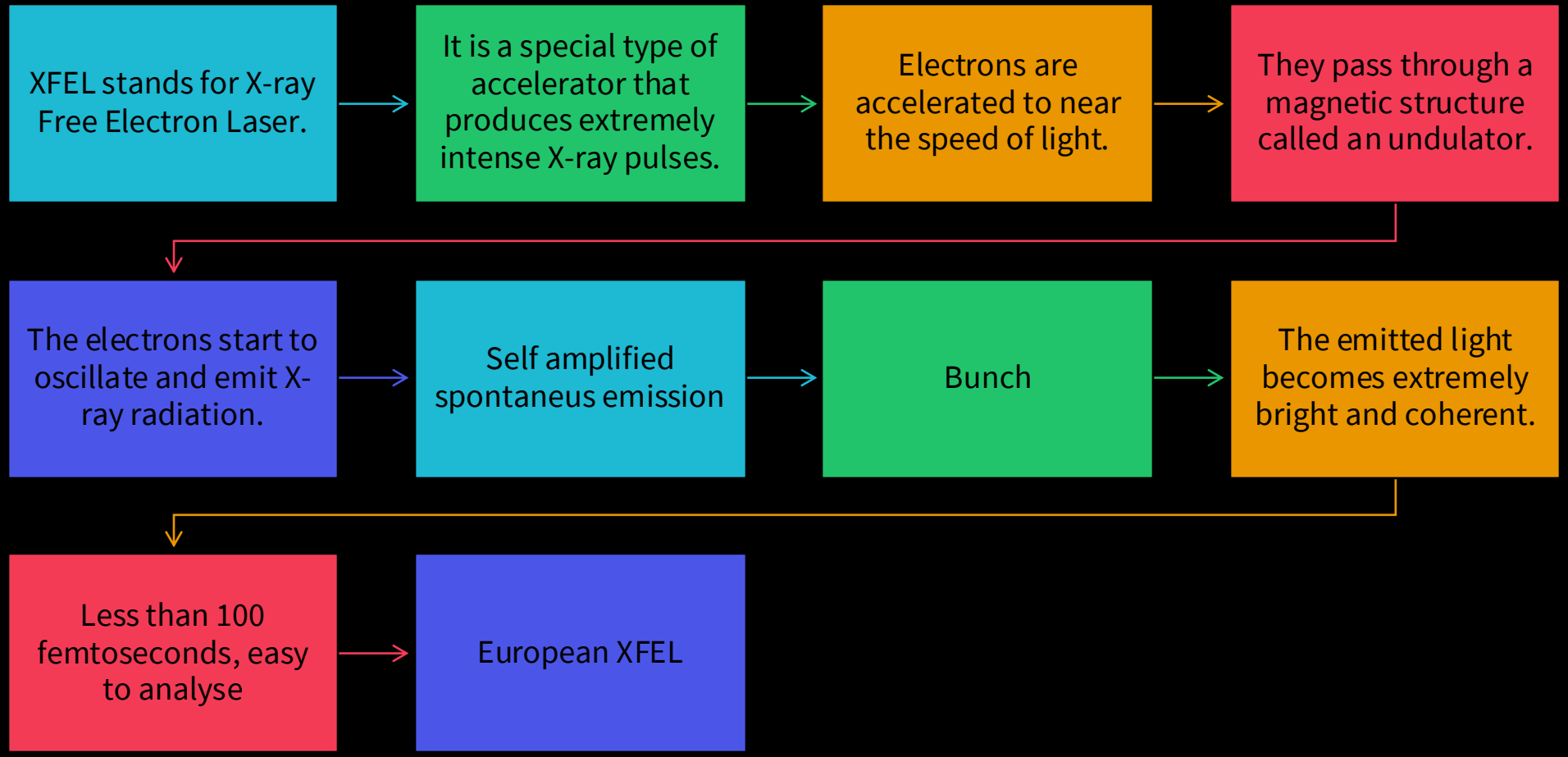
They can pass through many materials, including the human body.

Dense materials like bones absorb more X-rays and appear white in images.

Excessive exposure may damage cells.

Protective equipment (lead aprons) reduces radiation exposure.

What is XFEL?


XFEL stands for X-ray Free Electron Laser.
It is a special type of accelerator that produces extremely intense X-ray pulses.
Electrons are accelerated to near the speed of light.
They pass through a magnetic structure called an undulator.
The electrons start to oscillate and emit X-ray radiation.
Self amplified spontaneus emission
Bunch
The emitted light becomes extremely bright and coherent.
Less than 100 femtoseconds, easy to analyse
European XFEL