FROM TEACHERS FOR TEACHERS

Technologies
in STEM education

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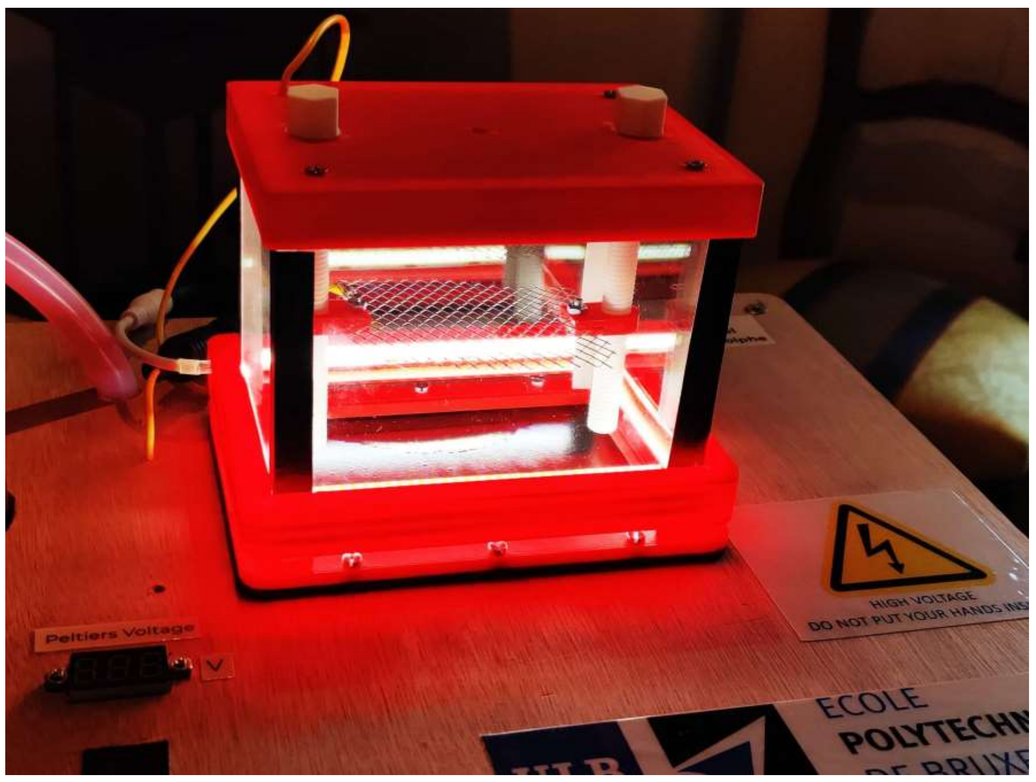
Understanding radioactivity – Cloud chamber

"The most original and wonderful instrument in scientific history" — Ernest Rutherford

Just above you, high-energy particles from outer space, called cosmic rays, crash wildly into molecules in the atmosphere, causing a chain reaction of particle decays. Further, we are exposed to particles emitted by radioactive elements present in the Earth itself, and even in the air we breathe. Therefore, we are surrounded by naturally-occurring ionizing radiation.

Today, we will show you how to make the paths of those particles visible to the naked eye using a cloud chamber, a device for which Wilson won a Nobel Prize in 1927. The fundamental principle is to maintain a gas in a supersaturation state, such that the passage of ionizing particles creates a track of ions acting as condensation nuclei on which "little wisps and threads of clouds" spontaneously form. This supersaturated gas can be obtained by filling the chamber with isopropanol and cooling the bottom surface of the chamber to a temperature below -20°C, *e.g.* by using Peltier modules.



It is now your turn to detect particles such as muons μ-, electrons *e*-, and many more! While looking to the trajectory of those particles, your students may have a lot of questions about the shape, length, thickness and frequency of those paths. The answer to those questions may involve numerous topics of physics, which will allow students to consolidate their knowledge and make connections between those topics.

Radioactivity is not well understood by the general public, despite the fact that it is used in medicine, industry, agriculture and energy. Therefore, there is an unaddressed need to improve the way it is taught. A cloud chamber is a pedagogical, playful and cost-effective solution to this need.

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