Physics eExp

Cloud (Wilson) chamber and observation of ionization tracks

A. Objectives: (i) Study the structure and working principle of Cloud chamber, and (ii) investigate ionization tracks generated in a Cloud chamber

B. Safety measure

Use a lifting tool to handle the radioactive source. Never touch a source with bare fingers. After finishing the experiment, place the radioactive source back in the container and wash your hands thoroughly.

Ref. 1 Physics eReference "Units and safety of nuclear radiation" [link]

C. Operation principle

A conventional cloud chamber is a container with dry ice (−78.5°C) at its bottom, which keeps downward diffusing alcohol supersaturated. Particles from a radioactive source placed inside the chamber ionize the molecules along their tracks. The ions act as condensation nuclei, around which alcohol vapour condenses and the tracks of the particles become visible. The cloud chamber used in this experiment (Fig. 1) utilizes electrically powered Peltier coolers instead of dry ice to maintain a low operation temperature (-40^{o}C).

Fig. 1 Cloud chamber using Peltier coolers.

D. Operation procedures

- Follow the instructions described in Operation Manual of ScienNovation-1 [link]. Remove the cover of **Rad-1-Cloud_Precipitation-v1**. Wet the cooling plate and the felt mounted on the inner wall of the cover with a layer of alcohol.
- Place the radioactive source on base plate.
- With the cover in place, switch on the main of the system to power the Peltier coolers, fans and LED.
- After a few minutes for cooling down the base plate, tracks of the particles can be seen at low ambient illumination condition.

E. Analysis

- Compare the tracks observed in the experiment with those as shown in the snapshot (Fig. 2). Also refer to the video: http://weather2.ap.polyu.edu.hk/cowinwiki/index.php/Radiation .

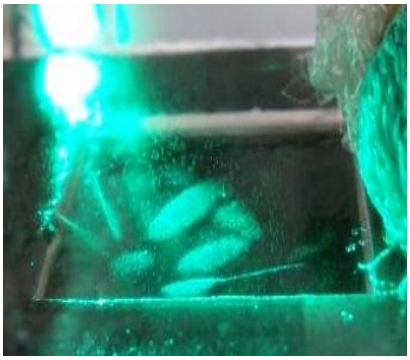

Fig. 2 A snapshot of the ionization tracks.

- From the shape of the tracks, identify the type of radiation from the source [ref].
- Cover the radioactive isotope with a thin aluminum foil. Observe the change of the track and reconfirm your conclusion on the radiation type.

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