Physics Exp
Cloud (Wilson) chamber and observation of ionization tracks

WONG Man Hon, WONG Yuen Wah and ONG Chung Wo
Department of Applied Physics, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong
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A. Objectives: Investigate generation of ionization tracks by using a Cloud Chamber

B. Safety of measurement

Never touch a radioactive source with bare hands. Whenever you need to transfer a radioactive material, always hold it with a lifting tools, like forceps. After the experiment, place the radioactive material back in a properly designed shielding case. Wash your hands thoroughly.

C. Operation principle

A conventional cloud chamber needs to have dry ice (−78.5°C) placed at the bottom to cause downward diffusion of supersaturated alcohol vapour. A radioactive source is placed inside the chamber. It emits particles to ionize the alcohol vapour molecules. The ions become condensation nuclei. The alcohol vapour molecules condense around the ions to generate visible tracks. The cloud chamber used in this experiment (Fig. 1) uses 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

- Remove the plastic case of cloud chamber. Wet the cooling plate and the felt located on the inner wall of the plastic cover with alcohol.
- Place a radioactive source on the base plate.
- Cover the chamber with the plastic case. Switch on the main of the system to power the Peltier coolers, fans and LED.
- Turn off the background light. After a few minutes until the base plate to reach a low enough temperature, observe the formation of ionization tracks just above the base plate.

E. Analysis

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

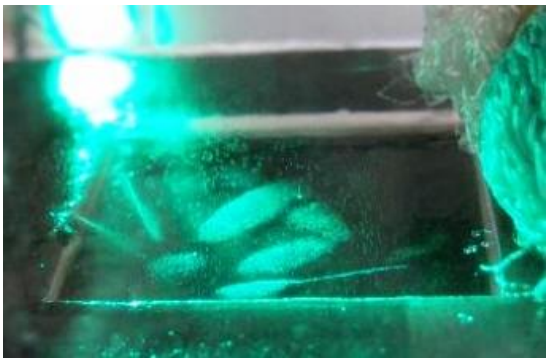

Fig. 2 A snapshot of the ionization tracks.

- From the shape of the tracks, identify the type of radiation.
- 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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