

The ‘Homemade’ Cloud Chamber

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1 Creating a Cloud Chamber.

The aim of this task was to demonstrate to teachers that a Cloud Chamber could be created on a small budget. This project was part of an outreach summer placement.

1.1 Equipment

Fish tank

Foam (thick rectangle of dimensions 2 inches more than the fish tank)

Felt

Metal Sheet (should fit snugly on the top of the fish tank, so that it can be sealed there)

Black duct tape

Cardboard box (should fit around the foam)

Stapler

Silicon sealant

Dry Ice

Isopropyl Alcohol

(Dimensions may be altered, as long as the function of that object still obtains the same end.)

1.2 Theory behind a Cloud Chamber

The Isopropyl alcohol becomes a vapour and the chamber is saturated with it. A steep temperature gradient is created with the dry ice so that, as the vapour drops to the bottom of the chamber, it is supercooled. Vapour isn't usually vapour at supercooled temperatures, so it will be very easily condensed into liquid form. Cosmic rays will pass through the supercooled vapour and ionise it. The ionisation means that electrons are removed from the vapour atoms, leaving them positively charged. Now being positively charged, the ionised atoms attract other nearby atoms, which starts the condensation process. We are then able to view the path of the cosmic ray as a spindly, short lived line of droplets. By placing a very strong magnet against a side of the chamber, one may see particles bend when they're in the magnet's field. This is because these particles have a charge, so their paths are altered by the field.

1.3 Setup of the Cloud Chamber

Fit the foam into the bottom of the cardboard box, and cut away the box so that it is slightly higher than the foam that's inside it. This will be the part of the cloud chamber that contains the dry ice. The foam

insulates the dry ice and will make the it last longer. Make sure the metal sheet is black on one side, either through blackening, black tape, or paint etc. This will allow for easier viewing of the particle paths. Roll or fold the felt so that it is a relatively thick piece of material, and secure using the stapler. Place the felt inside the fish tank, about 6 inches up from the open end of the tank, and seal it with silicon sealant to the edges of the tank. Whilst the sealant is out, ensure the edges of the tank are suitable to create an airtight environment. Soak the felt with the Isopropyl alcohol, then place the metal sheet on the open end of the fish tank, ensuring the black side is facing inside the tank. Now seal the sheet to the tank with the black duct tape, making sure it is airtight. Next place the dry ice into the foam. Turn over the fish tank, so that the metal sheet is now on the bottom, and place on top of the dry ice and foam.

After about 15 minutes, once the temperature gradient is sufficient, the vapour will be supercooled enough for one to start being able to observe the effects.



Figure 1: Photo of the final setup of the ‘homemade’ cloud chamber.