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**Title:** Observing Radiation using a Cloud Chamber

### **Synopsis**

Cloud chambers are visual particle detectors. A supersaturated vapor fills the bottom of a tank and ionizing particles cause the vapor to condense, and visible trails can be seen. They are currently used mostly for demonstrations, but historically were used as particle detectors in experiments, and were used in the discoveries of cosmic radiation, the positron, the muon, and kaons.

In addition to observing cosmic rays, the participants will observe tracks produced by the decay of a radiation source. Participants will see how different kinds of radiation decay produce tracks that are distinct from each other.

The presenter can focus on different topics for the demonstration: radioactive decay of a source, or cosmic radiation.

### **Audience**

Middle school and high school students

### **Learning Goals**

- Learn about particle detectors.
- Learn about types of radiation.
- It should be evident to the participants that we are surrounded by radiation.

### **Materials**

- Cloud Chamber
- Radiation source
- Power supply
- Projector for light
- Liquid nitrogen
- Ethanol



### Preparation and Set-up

1. Pour liquid nitrogen into tray. Place cloud chamber on top of tray.
2. Cover the bottom of the chamber with ethanol.
3. Connect power supply to the cloud chamber and turn on.
4. Turn on projector and arrange it so it shines into the chamber.
5. Place radiation source into opening. After a few minutes, trails will be visible.

### Guiding Questions

- What do you see?
- What do you think will happen when I insert/remove the radiation source into/from the chamber?
- Why do you think this is happening?
- Can you think of ways radiation is used in your daily lives?

### Activity Description

Participants will primarily be observing. The presenter has the option to encourage the audience to make sketches of observations.

### Teaching Strategies

The strength of this demonstration is that engaging the audience is quite easy, as people naturally find it interesting. The presenter can engage the audience further by asking leading questions. For exploration, the audience can draw what they see and make predictions for what happens when sources are changed. The demo relies heavily on explanation, so the presenter must explain the physics behind the demonstration clearly.

### Vocabulary

- Cloud chamber
- Ionizing radiation
- Alpha particle
- Beta particle
- Positron
- Muon
- Antimatter
- Particle physics



## Science Content Background and Additional Resources

**Dangers:** Radiation source is harmful if swallowed. Liquid nitrogen harmful if swallowed or handled with bare skin. Liquid nitrogen can also cause suffocation in an enclosed environment and there is a risk of explosion if stored in a sealed container. Denatured alcohol is also dangerous if swallowed.

**Precaution:** Participants will not be allowed to handle radiation sources. Liquid nitrogen will not be accessible to students since it will be in a tray under the cloud chamber and stored in a Dewar behind the table. Ethanol is also kept away from the audience. Liquid nitrogen will be stored in an approved container.

**In the unlikely event of ingestion of radiation, call poison control.**