

The Thermoelectrically Refrigerated Cloud Chamber

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A diffusion cloud chamber is a detector of ionizing radiation, which offers an opportunity to observe subatomic particles directly and to make various experiments related to particle physics. However for certain problems cloud chambers are not as easily accessible for schools as they could be: some cloud chambers require badly accessible external refrigerating and others are not appropriate because of their dimensions, weight or cost. Therefore the research focused on development of a new cloud chamber of convenient dimensions, appropriate cost and good observation results, without the need of external refrigerating media. The essential condition for proper operation of a diffusion cloud chamber is a great temperature difference between a cover and a bottom of the chamber. The difference was reached by warming the cover up and refrigerating the bottom. For that it was necessary to develop a new refrigerating system – the mechanism is based on semiconductor thermoelectric units cooled by a water circuit. The observation results were significantly improved by removing free ions from the detection area, which was reached by the placement of an electric field inside the chamber. In this cloud chamber there was observed alpha, beta and gamma radiation both from artificial sources and from natural background radiation. A better identification of particles can be reached by appending of a homogeneous magnetic field. The result of the research is a functional prototype of a diffusion cloud chamber, which is easily operable, gives very good observation results and can be easily applied in education.