Answer on Question #51450, Physics, Solid State Physics

With the help of a diagram, explain the working of a synchrocyclotron in your own words.

Answer:

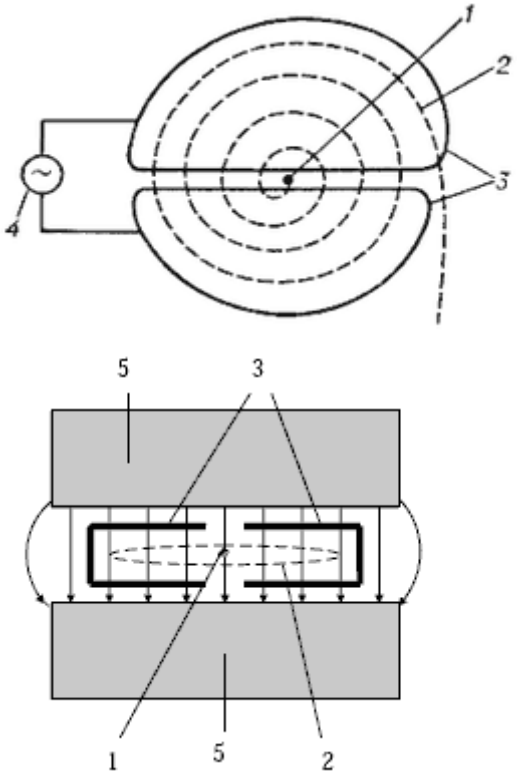

Fig. 1. Scheme of the cyclotron top view and side view: 1 - source of heavy charged particles (protons, ions), 2 - accelerated particle orbit, 3 - accelerating electrodes (dees), 4 - generator of the accelerating field, 5 - electromagnet. The arrows indicate the magnetic field lines). They are perpendicular to the plane of the top drawing

Synchrocyclotron is the cyclic accelerator nonrelativistic heavy charged particles (protons and ions) in which the particles move in a constant uniform magnetic field, and to accelerate their uses high-frequency electric field is constant.

Diagram of the device is shown in Figure 1 of the cyclotron. Heavy charged particles (protons, ions) enter the chamber from the injector near the center of the chamber and are accelerated by an alternating field of fixed frequency applied to the accelerating electrode (two of them and they are called dees). Particle with charge Ze and mass m moving in a constant magnetic field of strength B, directed perpendicular to the plane of motion of the particles, by unwinding spiral. The radius R of the particle trajectory and velocity v, is given by the Eq.(1)

$$R = \frac{mv}{ZeB}\gamma \tag{1}$$

where $\gamma = 1/\sqrt{1-(v/c)^2}$ γ = [1 - (v / c) 2] 1/2 - relativistic factor.