A NEW TYPE OF SUBMILLIMETER WAVE GENERATOR UTILIZING TURBOSTRATIC CARBONS

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We want to suggest a possible usage of pyrolytic carbons (P.G.) to construct a new type of radiation detector and generator at submillimeter and infra-red wavelengths. The experimental verification of this idea has been planned but is not in time at the date of the preregistration for this conference. An expected advantage of the proposed device is its tunability over a wide range of wavelengths.

In an ordinary conductor application of a magnetic field quantizes the energy associated with electronic motions in the plane perpendicular to the field. But the carrier motions in the direction of the field are not affected by the magnetic field, and so the total energies of the carriers are distributed over a certain band. However, if an ideal two-dimensional material does exist, a magnetic field will quantize the total energy. The operation principle of the proposed device is based on such a sort of two-dimensional Landau levels. As is demonstrated by the present author elsewhere at this conference, the energy structure of P.G. is almost two-dimensional. At present P.G. seems to be the only choice for the proposed device.

P.G. can be obtained in a form of a massive block in which two regions, whose c-axes make right angles to each other, are bounded by a sharply defined plane. Under the coexistence of a magnetic and an electric field, current is carried by the carriers of the Landau levels which lie in the vicinity of the Fermi level. When the current is along the length of such a block, carriers must make transition between the levels at the junction. The difference of the carrier energy before and after the transition is emitted or absorbed in the form of photon or phonon. The operation of the device is based on this process.

Positions of the Landau levels needed in the design of a practical device are calculated on a computor, for realistic values of parameters.

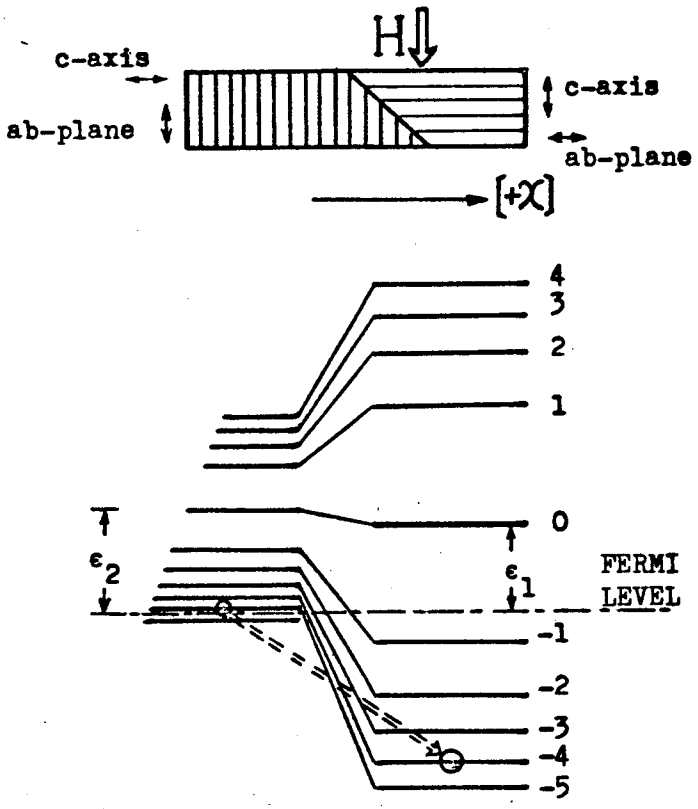

FIGURE 2.

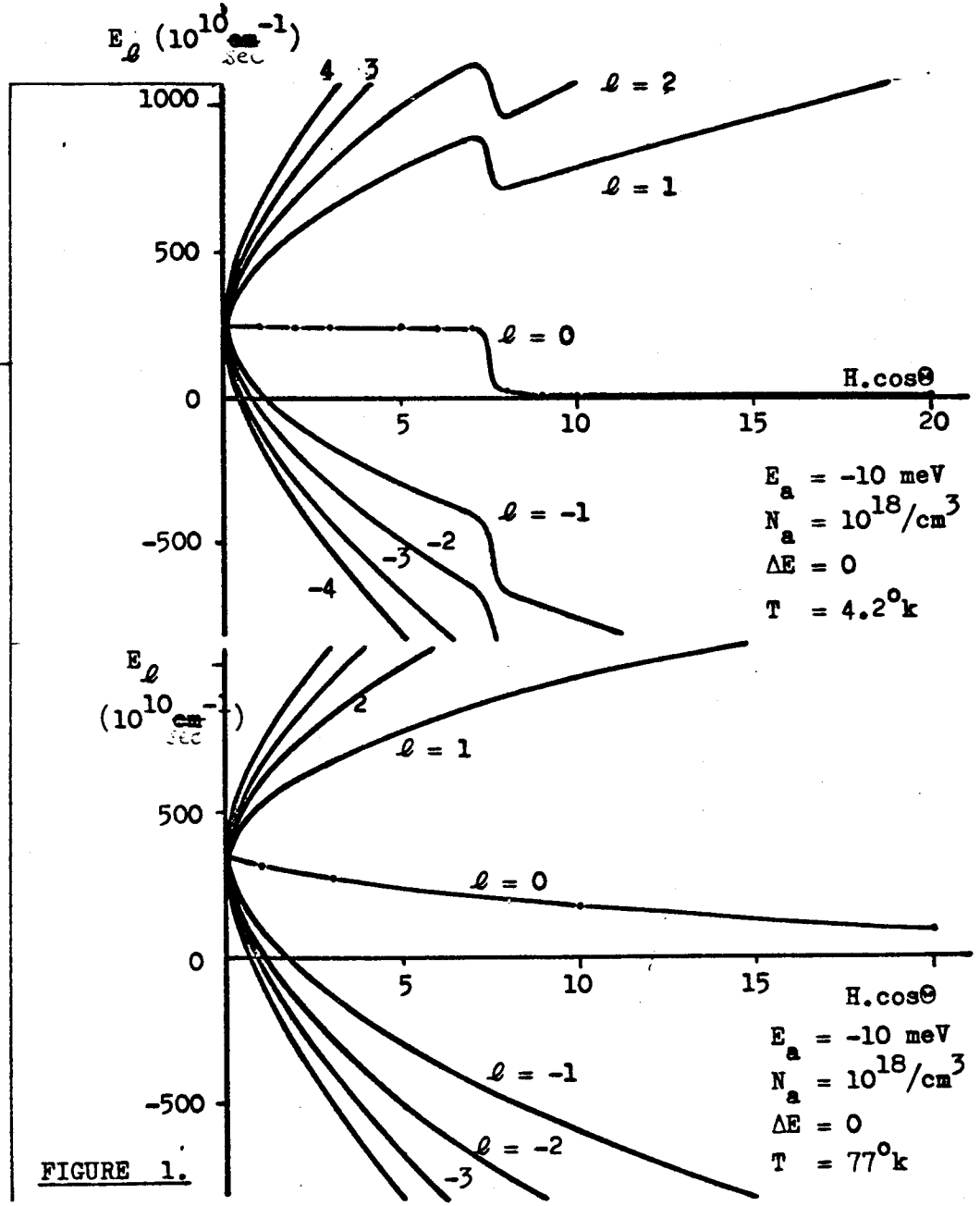

FIGURE 1.