pairs can be expressed as an effective mass of a conjectured object which, when disintegrating into pairs of electrons, would give rise to the observed distribution. The distribution in effective mass as observed in the Brookhaven experiments exhibited a sharp peak, as shown in fig. 16, located at an energy of 3·1 GeV. At the same time, experiments carried out by Burton Richter and collaborators with the SPEAR storage ring at SLAC showed that the yield of many kinds of particles, including electrons, muons, pi mesons, neutrons and protons, showed a sharp peak when the total energy of collision of electrons and positrons was near the same energy of 3·1 GeV. Figure 17 shows these observations.

As future developments indicated, the storage ring methods proved to be more powerful for investigating these new phenomena, and I will therefore restrict the following discussion to the results obtained with electron–positron storage rings subsequent to the original discoveries.

What made these discoveries a 'revolution'? There was little expectation that energy distributions of any kind at these high collision energies could exhibit such a narrow peaked structure. The reason for this assumption, in retrospect naive, is quite simple. If new particles or objects are formed at these high energies, then there is plenty of energy available for them to decay rapidly into many of the lighter particles that are already known. The greater the energy available for such disintegrations, the shorter is the life of the parent particle. And the shorter the lifetime of a new particle, the less well-defined its mass or energy would have to be according to the energy-time formulation of the uncertainty principle which is usually written as $\Delta E \Delta t \simeq h/2\pi$. Thus the only way the sharpness of these peaks could be explained is by postulating a new 'selection rule', that is, some new physical principle that inhibits the rate of disintegration. In turn, a new

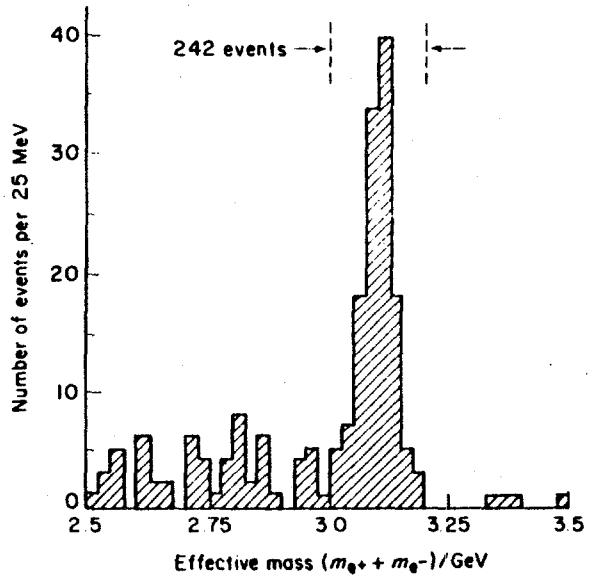

Fig. 16. Distribution in the *effective mass* of electrons and positrons produced at the Alternating Gradient Synchrotron at Brookhaven National Laboratory through impact of a high energy proton beam on a beryllium target as observed by Sam Ting and collaborators.