

MEETING IX BEVATRON RESEARCH CONFERENCE
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4 PM Auditorium, Bldg. 50

Robert Karplus: Bevatron Physics

General

A large number of experiments relating to nuclear structure and materialization of energy will fall within the energy range of primary and secondary particles available from the Bevatron. Some experiments of interest are outlined below with pertinent comments.

Direct Reactions

Proton-proton scattering can be extended to the high energy range using liquid hydrogen targets and hydrogenous materials by bombarding the target with the internal beam or using externally scattered protons. Proton-deuteron scattering measurements using liquid deuterium targets or solid materials can also be extended. Proton scattering from heavier nuclei may be found less difficult to interpret at these level energies as the nucleons will interact more or less independently. The wavelength of the bombarding particles will now be much smaller than nucleon diameters.

Secondary Reactions

Nuclear collisions represent by far the most important interaction between high energy nucleons and matter. Proton-neutron charge exchange interaction within the internal target will provide an external flux of neutrons which can be used directly for total nuclear cross section measurements and neutron-proton scattering. Low energy measurements, say below 200 Mev, show that nuclear interaction cross sections do not go down as $1/\lambda^2$ as reactions become predominantly nuclear rather than electromagnetic. Measurements can now be extended into the Bev range to investigate the complex as opposed to the point charge concept of nuclear interactions. The external neutron beam may also provide high energy protons in charge exchange interactions with external targets.

Mesons produced in the internal target will provide external meson beams of all types for cross section measurements over a large range of energies.

Sufficient energy will be available for production of V particles with reasonable cross sections. The primary event leading to the production of V particles and the characteristic mode of decay can be studied. These events are best adapted to cloud chamber techniques wherein co-planer events can be recognized. In addition, cloud chamber measurements will permit study of simultaneous events, whereas ambiguity might arise using nuclear emulsions.

Materialization of Energy

The kinematics of the collision process indicate that the anti-proton threshold will be attained at the Bevatron energy. It may be difficult to detect proton pairs even if they are produced, because the angular distribution of the anti-protons will be small and will be contained within that of the emerging meson beam. It may be possible to identify the anti-proton in terms of the Q-values of its interactions.

Anti-neutrons may be detected on the basis of energy decay and in an interaction

and may be identified by a large angle event producing several mesons.

The detection of anti-neutrinos may be expected to be as difficult as the detection of neutrinos.

Thin targets and short monitoring distances may increase the difficulty of finding anti-particles.

Charge Distribution Measurements

Charged π -meson beams, if allowed to decay without collision, will produce μ -meson beams suitable for measuring the charge distribution on nucleons and protons. A μ -meson is a more desirable particle than the electron for charged distribution measurements, in that the relatively massive high energy μ -meson will scatter elastically. The identity of μ -meson tracks can be distinguished from those due to random collision events by a path direction comparison in nuclear emulsions.

Summaries: Harry Heard
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