THE CONFERENCE AND ITS BACKGROUND

This International Conference on Isochronous Cyclotrons reflects an increased awareness* of potentialities in intermediate energy (E <1 GeV) nuclear physics. The conference is the fourth in a series initiated at Sea Island in 1959. The imaginative and creative efforts of this growing international group of cyclotron builders have, in a very large part, been responsible for making the medium energy field accessible. Having served all four conferences, the Editor takes the liberty of briefly reviewing the series.

The demonstrated success of the Lawrence cyclotron in the early 1930's resulted in a world-wide wave of cyclotron construction, the standard fixed-frequency machines. The discovery of phase stability by Veksler and by McMillan in the mid-1940's started a second wave of construction, the frequency-modulated cyclotrons. By 1958 about 60 standard FF cyclotrons were in operation or nearing completion, and 18 FM machines were in use. Significantly, no new projects for the construction of either the standard FF or the FM cyclotrons were reported in 1958; the interests of accelerator development groups had been captured by the possibility of using the Thomas[1] azimuthally-varying field (AVF) to achieve isochronous acceleration, and thus to surmount the limitations of existing cyclotron types.

Becoming aware of a third wave of interest, A. H. Snell organized the first conference in the new field under the auspices of the National Academy of Science and the National Research Council. At this Sea Island Conference[2] in early 1959 the enthusiastic delegates, 85 from six countries, re-examined the long-neglected Thomas proposal; welcomed reports on the successful operation of the first electron and proton models; and analyzed the design goals and problems of the five machines then under construction, and the hopes and aspirations of seven other groups. Although a proton energy of only 9 MeV had been achieved in the machines, many theoretical studies and supporting design schemes were advanced for maintaining isochronism well into the relativistic region. Of the cyclotrons considered at Sea Island, 14 out of the 15 were subsequently built and successfully operated. Of the participants, some 30% were present at the 1966 conference, including over 20 "charter members" who had never missed a conference!

Rapid developments in the field called for a second conference,[3] which was organized by B. T. Wright, at the University of California, Los Angeles, in 1962. By then 11 machines were already in use, 12 more under construction, and 18 groups had hopeful design and study projects. The first extension of isochronous operation into the relativistic range, 52-MeV protons, had been reported by the host institution; some groups were so encouraged as to propose "meson factories" in the 400-800 MeV energy range. An exciting last-minute paper from Colorado described the success and advantages of accelerating H^- ions. The international group of delegates had grown to 139.

The following year meson factories were included in the title for the third conference,[4] sponsored by the European Organization for Nuclear Research at Geneva, in April 1963. The number of isochronous cyclotron projects had increased to 44, with 15 operating and 11 under construction. Several machines had crossed the relativistic threshold. The confidence of theorists and design engineers alike was rewarded and reinforced by the many reports confirming the predicted dependable and versatile performance of these new machines. P. M. Lapostolle, conference organizer, observed that, "This achievement is already a great incentive to machine builders, and the development of the theory has also lead to a better understanding of conventional cyclotrons, synchro-cyclotrons, and of the extraction processes in all similar accelerators."

During this fourth conference, organized by R. S. Livingston as the International Conference on Isochronous+ Cyclotrons, the proliferation of interests suggested by Lapostolle in 1963 became evident indeed. Discussions concerned not only the 42 isochronous cyclotrons

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*See R. S. Livingston's Closing Remarks, page 415.

+The term "isochronous" is now more commonly used than "sector-focused," perhaps because it is more conveniently used in acronymic devices, such as ORIC, MUSIC, and KRIZ.

FR-002 Reprinted from IEEE Transactions on Nuclear Science NS-13 (4), Aug 1966 © IEEE 1966

now in operation or under construction, but also included: a competing linac meson factory, several proposed FM cyclotron conversions, three separated-orbit cyclotrons, the "Omnitron," and many specific design problems which extend to accelerators in general. The performance record achieved by the present generation of new machines now surpasses most of the expectations of those who advanced the basic theories and design concepts at Sea Island only eight years ago. Negative-ion acceleration and stripping is an accepted practice. Axial injection of ions, particularly polarized protons, is perhaps the most enticing new development. Clearly, the many desirable characteristics now so convincingly demonstrated by these isochronous cyclotron installations are having an effect on the design of other types of accelerators. So many FF cyclotrons have already been converted that they now number fewer than the AVF machines. Magnet sectors are being introduced into FM machines. Several corporations, in both Europe and the USA, are offering AVF machines packaged to specifications. The advocates of isochronous meson factories, restive since 1962, were heartened by reports of real progress in accelerator cavity work at Zurich and by the very recent approval of the 510-MeV project there. The separated-orbit cyclotron, first suggested at CERN in 1963, is already being seriously considered in at least three installations; it may, in fact, represent the fourth wave of cyclotron development.

The vigor of the present wave of cyclotrons is clearly indicated by the records of the four conferences. The growth of interest during this eight-year period can be summarized as follows: AVF cyclotrons operating or under construction advanced from 7 to 42, listed projects from 14 to 60, isochronous operation achieved from 9 to 70 MeV (protons), energy aspirations upward to 1000 MeV, conference participants (invitation-limited) from 85 to 229, and international representation from 6 to 15 countries and two international laboratories (CERN and JINR). The tremendous success of these four conferences should be a source of considerable satisfaction to each of the conference organizers; undoubtedly the conferences have provided a significant driving force for this third wave, and for the expansion of intermediate nuclear physics in general.

It was the recommendation of the 1966 Organizing Committee that the next conference in this series, ". . . would occur in about 1969 . . . somewhere in Europe." We are confident that, then as in 1962 and 1963, a statement made by A. H. Snell in summarizing the 1959 Sea Island Conference will continue to be just as relevant--". . . the general tenor of this Conference implies a confidence that with energies variable into the relativistic range, and with sundry ion species under acceleration, the new cyclotrons will introduce a new sweep and compass into research upon the physics of nuclear reactions."

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Editor of the Proceedings

References

1. L. H. Thomas, "The Paths of Ions in the Cyclotrons," Phys. Rev. 54, 580-98 (1938).

2. Sector-Focused Cyclotrons, Proceedings of an Informal Conference, Sea Island, Georgia, February 2-4, 1959. National Academy of Science and National Research Council, Publication 656 (1959). (291 pages)

3. Proceedings of the International Conference on Sector-Focused Cyclotrons, University of California, Los Angeles, April 17-20, 1962, Nucl. Instr. and Meth. 18-19 (1962). (646 pages)

4. International Conference on Sector-Focused Cyclotrons and Meson Factories, CERN April 23-26, 1963. CERN Report 63-19 (1963). (418 pages)

