

The International Committee for Future Accelerators (ICFA): 1976 to the present*

Roy Rubinstein[†]

Fermilab, P.O. Box 500, Batavia, Illinois 60510, USA

Published 14 December 2016

The origins of the International Committee for Future Accelerators (ICFA) are described, together with its role in the particle physics community; also discussed are some of its past and current major activities.

1. Introduction

The International Committee for Future Accelerators (ICFA) has been in existence now for four decades. It plays an important role in allowing discussions by the world particle physics community on the status and future of very large particle accelerators and the particle physics and related fields associated with them. This article gives some indication of what ICFA is and does, and also describes its involvement in some of the more important developments in the particle physics field since its founding.

2. Origins

The origins of ICFA go back to the late 1960s; a series of East–West meetings was held during 1967–1976 to review future perspectives in particle physics. By the end of that period, there was a belief that the next large accelerator, after the Fermilab and CERN 400 GeV synchrotrons, would of necessity, because of its complexity and cost, be an international machine. A key meeting in ICFA's formation took place in New Orleans in 1975. Some 50 particle physics world leaders passed a resolution recommending the formation of a group to study the scientific, technical and organizational problems connected with worldwide collaboration in the construction of a very large accelerator. This recommendation led IUPAP's

*The ICFA website (<http://icfa.fnal.gov>) contains more information on several of the topics discussed here, and also includes a listing of past and current ICFA members.

[†]ICFA Secretary 1993–2016.

Commission 11 (C 11, Particles and Fields) to create ICFA in 1976, with formal establishment in 1977.

Included in the original C 11 terms of reference for ICFA were:

“To organize workshops for the study of problems related to an international super high energy accelerator complex (VBA) and to elaborate the framework of its construction and of its use” (the VBA was envisioned as a ~ 20 TeV proton accelerator which could allow colliding beams), and

“To organize meetings for the exchange of information on future plans of regional facilities and for the formulation of advice on joint studies and uses.”

3. ICFA Membership and Meetings

There is a formula for ICFA membership, which is approximately representative of particle physics activity in the different regions of the world. Since 1995, this has been (member numbers in parentheses): CERN member states (3), USA (3), Japan (2), Russia (2), Canada (1), China (1), Other Countries (3); the Chair of C 11 is an ex-officio ICFA member. ICFA members are nominated by designated authorities in their countries or regions, followed by C 11 confirmation. Member terms are 3 years, and can be renewed. The ICFA Chair (a three year term) is chosen by the ICFA membership.

ICFA meetings are typically held twice a year, with invitations to the longer of the two meetings going also to the directors of all of the world’s major particle physics labs; this allows a much more extensive discussion of the current and future status of particle physics.

4. ICFA Guidelines

In 1980, ICFA produced Guidelines for the utilization of major regional facilities for particle physics research; these were reaffirmed in 1993. Two of the Guidelines are:

“The criteria used in selecting experiments and determining their priority are (a) scientific merit, (b) technical feasibility, (c) capability of the experimental group, (d) availability of the resources required.”

“Operating laboratories should not require experimental groups to contribute to the running costs of the accelerators or colliding beam machines nor to the costs of their associated experimental areas. *However, in particular for a large global facility, allocation of operating costs should be agreed by the project partners before project approval, while still allowing open access for experimental groups.*”

The italicized sentence above was added in 2011 to incorporate possible changes needed for a large global facility such as the International Linear Collider (ILC).

5. ICFA Panels

There are accelerator and particle physics topics of a technical nature where international discussion and collaboration is needed, and where the required expertise is beyond that of the individual ICFA members. Because of this, ICFA has set up Panels, each of ~ 16 experts from around the world, on specific technical areas. The topics of the current (2016) Panels are:

Instrumentation; beam dynamics; advanced and novel accelerators; international connectivity; particle physics data preservation; accelerator-based neutrino facilities; the Linear Collider Board.

Each Panel organizes its own program, which can include workshops, newsletters, schools, etc., and each Panel regularly reports at ICFA meetings.

6. ICFA Seminars

The first ICFA Seminar was held in 1984, as noted in Sec. 7. Since then the Seminars, with the title “Future Perspectives in High-Energy Physics,” have been held every 3 years. They generally run for three and a half days, usually take place at a major particle physics laboratory, and have an invitation-only worldwide attendance of ~ 150 to 200; government science officials and media representatives are also invited. Review talks are given at the Seminars on the state and prospects of accelerators, particle physics, and related fields around the world.

7. ICFA and the SSC

At the August 1983 ICFA meeting, there was much concern expressed about the newly announced US SSC, a 20×20 TeV proton–proton collider which, as a national project, was not compatible with ICFA’s goal, noted in Sec. 2, that such a machine be international. This concern led to the organization of the first ICFA Seminar, held at KEK in May 1984, and the SSC was the central topic of discussion at the Seminar. A major outcome was a significant change in ICFA’s goals, as noted in a summary of the Seminar subsequently given by the then ICFA Chair; this summary included the statement: “ICFA views its major role as facilitating the construction of high-energy accelerators and not as arbitrating among various national or regional options.”

In 1985, ICFA redefined its aims to be:

“To promote international collaboration in all phases of the construction and exploitation of very high energy accelerators.”

“To organize regularly world-inclusive meetings for the exchange of information on future plans for regional facilities and for the formulation of advice on joint studies and uses.”

“To organize workshops for the study of problems related to super high-energy accelerator complexes and their international exploitation and to foster research and development of necessary technology.”

8. ICFA and the Termination of the SSC and Approval of the LHC

In October 1993 the US SSC was canceled. Within days, many in the world particle physics community urged ICFA and its then Chair (John Peoples of Fermilab) to take the initiative and start discussions on the field's situation following this cancellation. Peoples immediately initiated contacts with many relevant parties, and then called a special ICFA meeting in December 1993 to review the situation. At that meeting, there was a report on the LHC status (it was not yet an approved project), its projected funding shortfall, and on possible non-CERN-member contributions to the project.

A previously scheduled ICFA meeting the following month had the LHC as its major topic. An ICFA Statement was issued noting the worldwide interest in participation in the LHC, and urging the CERN Council to find appropriate mechanisms to bring non-member states into the project. Following the initial LHC approval by the CERN Council, in January 1995 ICFA “warmly welcomes the approval of the . . . LHC” and in October 1996 noted that “the LHC . . . is essential for the progress of the field” and “the LHC is becoming a true world facility.” In January 1997 it noted “with great satisfaction” that the LHC was now approved for construction in a single stage.

9. The International Linear Collider

By the early 1990s, a consensus was emerging among the particle physics communities of the world that a linear e^+e^- collider with center of mass energy in the 100s of GeV to a TeV was the next major accelerator needed for the field following the SSC and LHC hadron colliders. The issue was raised often at ICFA meetings in the 1990s, and several ICFA Statements from 1993 onwards reiterated this consensus. However, no nation was ready to take the lead on the R&D and design of this machine, so ICFA itself from ~ 2000 onwards organized linear collider activities for the world particle physics community, and has continued to do so to the present time.

In 2002, ICFA formed the International Linear Collider Steering Committee (ILCSC) to facilitate the realization of the International Linear Collider (ILC) as a global collaborative effort; its initial chair was Maury Tigner. ILCSC was assisted in its work by the Machine Advisory Committee (2006–2007, chaired by Ferdinand Willeke) and the Project Advisory Committee (2008–2012, chaired by Jean-Eudes Augustin and then Lyn Evans).

A first ILC Technical Review Committee, created by an interlaboratory collaboration and chaired by Greg Loew of SLAC, produced a report in 1995 giving in one document the current status of the eight major e^+e^- linear collider designs then being pursued around the world. In 2001, ICFA requested that the Committee reconvene and produce a second report; by then there were four major remaining designs: TESLA, JLC-C, JLC-X/NLC, and CLIC. The report, completed in 1993, contained summaries of machine parameters of each, together with still-needed

R&D on each, and the potential of each to reach energies above 500 GeV c.m. Also in 2003 a Parameters Committee (chaired by Rolf Heuer) set up by ILCSC produced a recommended set of performance parameters for the ILC, which was subsequently updated in 2006; these parameters were used by the GDE (see below) as ILC design criteria.

By 2004, there were only 2 major technologies still being pursued in the world for the main linacs of a linear collider with c.m. energy range up to 1 TeV: room temperature X-band (11.4 GHz) and superconducting L-band (1.3 GHz). However, it was becoming clear that it would be too expensive for the community and its funding agencies to continue R&D on both technologies, since it was very unlikely that two linear colliders would be built; so a choice between the two needed to be made. ILCSC set up the International Technology Recommendation Panel in 2003, chaired by Barry Barish, to recommend which technology to pursue. The Panel's recommendation in its 2004 report was to go forward with the superconducting option; this was immediately accepted by ICFA, and the world particle physics community quickly united behind this technology choice.

ILCSC set up the Global Design Effort (GDE) in 2005, with Barry Barish as Director, to produce a technical design for the ILC, and in 2007 Sakue Yamada was appointed ILC Research Director. The GDE completed its work with the publication of the Technical Design Report in 2013; following successful technical and cost reviews of the design, the GDE and ILCSC both went out of existence in 2013.

In 2013, ICFA established the Linear Collider Board (LCB) to succeed ILCSC; in addition to overseeing the work on the ILC, it also oversees the CLIC project (a linear collider with potential for higher energies than ILC, but with several years more R&D still needed) and the CLIC and ILC detectors. Under the LCB is the Linear Collider Collaboration (LCC), with Lyn Evans as Director, to coordinate and direct the global effort towards realizing a linear collider.

10. Relations with FALC

FALC, originally Funding Agencies for the Linear Collider and now Funding Agencies for Large Colliders, was established in 2003 as an informal group of particle physics funding agency representatives. It has had an important relationship with ICFA: the FALC chair is invited to ICFA meetings, and the ICFA and ILCSC (now LCB) chairs attend FALC meetings. In addition, the GDE (now LCC) Director gives reports to FALC, and FALC provided the common fund for the GDE, and continues to do so for the LCC.

11. Some Other ICFA Activities

ICFA has considered many topics relevant to particle physics in addition to those noted above. Among them are the issuance of a 2007 Statement supporting open-access journals for particle physics publications, and in 2006 strongly encouraging the coordination of the three then-existing large regional accelerator conference

series into the current schedule of one major international accelerator conference held annually.

12. Summary

ICFA plays an important role as a forum for discussions transcending national or regional boundaries on the future of high energy accelerators and their associated particle physics, detectors, and technology. It is probably true that, to paraphrase an old expression, if ICFA did not exist, something very similar would have to be invented. As also appeared to be true in the 1970s, projects under consideration in the field are becoming so large and costly that no single country or group of countries can carry them out alone. This is very relevant if the next major accelerator is a linear e^+e^- linear collider in the hundreds of GeV or TeV energy range.

Acknowledgments

The early ICFA history given here relies significantly on conversations with, and published and unpublished work of, the late Owen Lock, ICFA Secretary from 1978 to 1992. The author also thanks the three people who were ICFA Assistant Secretaries during the time that this position existed: Helga Schmal (1987–1998), Claire Earnshaw (1999–2002), and Brigitte Beuseroy (2002–2006).