

# Seeds of history sown on Shelter Island

In the first four days of June 1947, a four-day conference was held at Shelter Island, bringing together 23 top-notch physicists in what turned out to be a landmark meeting. At this conference Willis Lamb announced that he and his student, R. C. Retherford, had for the first time measured an effect of the self-energy of the electron in the hydrogen atom. On the train going back to Schenectady, Hans Bethe made a rough calculation of the Lamb shift. By the following year, other physicists who attended the Shelter Island conference had made a relativistic calculation of the Lamb shift: Lamb with his student Norman Kroll, Victor Weisskopf with his student Bruce French, and also, using new, obviously relativistic methods, Richard Feynman and Julian Schwinger. Feynman's methods have enormously simplified calculations in quantum field theory ever since; they were simple and elegant enough to allow a systematic treatment of the infinities. (Meanwhile in Japan, earlier than and independently of the conference, Sin-Itiro Tomonaga had also developed an obviously relativistic method.) Another noteworthy development at the Shelter Island conference was Robert Marshak's two-meson hypothesis. Soon after, the pion was discovered experimentally.

This June, most of the veterans of the 1947 Shelter Island conference met again at Shelter Island in a three-day meeting organized by Nicola Khuri, who has a summer home there. In addition, many of the best known younger theorists attended. The agenda was quantum field theory and the fundamental problems of physics. In the keynote address, Murray Gell-Mann said that quantum electrodynamics was invented around 1929 and never changed. "But just after the Shelter Island meeting it was understood to be renormalizable and to give definite predictions to every order in

perturbation theory." The theory has now "been generalized to include the strong and weak interactions along with electromagnetism—with quarks and neutrinos along with the electron, and the mysterious three families. Otherwise it's the same theory." Instead of one dimensionless parameter, it has very many.

"After 35 years of trying, theorists have been unable to invent any scheme for rendering a plausible theory finite or renormalizable unless they can do so in perturbation theories." Gell-Mann said he remembers many occasions when it was announced that somebody had succeeded in solving that problem, just as mathematicians are told all the time that somebody has proven Riemann's conjecture. In fact, the day before the conference began, André Martin told Gell-Mann the following probably apocryphal story: Before giving a speech in Berlin, Hilbert had sent a telegram saying that he had proven Riemann's conjecture. Then he arrived, and the audience was very disappointed in the speech because he said nothing about having proved Riemann's conjecture. It turned out he had sent the telegram in case he was killed on the way, during his first airplane trip.

Gell-Mann went on to express hope that a unified theory could be found, including gravitation, that would be finite in perturbation theory and have no dimensionless parameters or very few. Candidates might be superstring theory or  $N=8$  supergravity.

A look at the impact of the first Shelter Island conference was provided by Bethe, Weisskopf, Lamb, Tom Kinoshita, Yoichiro Nambu and Marshak, with occasional remarks from some of the other 1947 participants.

Other speakers included Steven Weinberg on calculation of fine-structure constants; Isadore Singer on global geometry in quantum field theory; T. D.

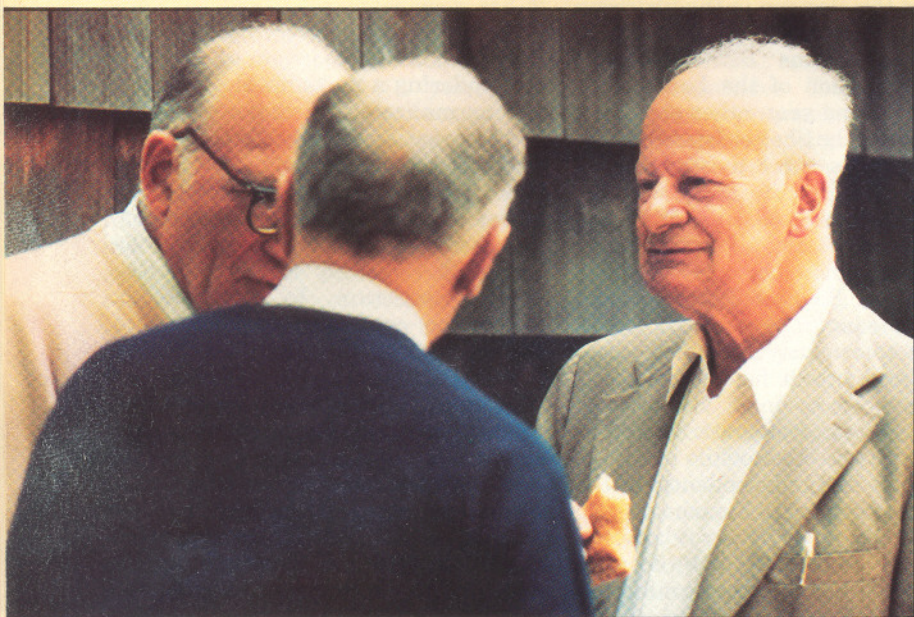
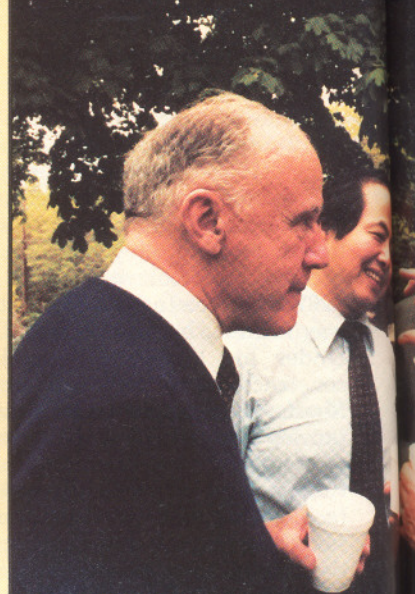


Participants at the historic first Shelter Island conference, which was held 1 through 4 June 1947. For those unable to identify all the physicists shown, see the key on page 123.



Lee on time as a dynamical variable, discrete mechanics and random-lattice field theory; Roman Jackiw on semiclassical and topological methods in field theory; Gerard 't Hooft on the ambiguity of the equivalence principle and Hawking temperature; Bruno Zumino on supersymmetry and supergravity; Paul West on finite theories in supersymmetry; Michael Duff on su-

perunification from 11 dimensions; Stephen Adler on induced gravity; Stephen Hawking on the cosmological constant; A. D. Linde on the chaotic inflationary universe; Alan Guth on the inflationary universe; John Schwarz on superstrings; Edward Witten on the fermion quantum number in Kaluza-Klein theory; and Richard Feynman on how QCD works. —GBL



▲ From left: Sidney Drell, John Wheeler, Hans Bethe at coffee break.

▶ Francis Low



▼ Edward Witten



▲ Stephen Hawking and (behind) Nicola Khuri

▼ Freeman Dyson. In rear are members of a film crew that videotaped the conference.







◀ From left: John Wheeler, T. D. Lee, Linus Pauling, Marvin Goldberger on the terrace of the Pridwin, also the site of the first Shelter Island conference.

▼ From left: Francis Low, Yuval Ne'eman, Murray Gell-Mann, Frederick Seitz



▲ I. I. Rabi



◀ Foreground (from left): Gerard 't Hooft, Helen Quinn. Rear (left): Richard Feynman

▼ Richard Feynman

