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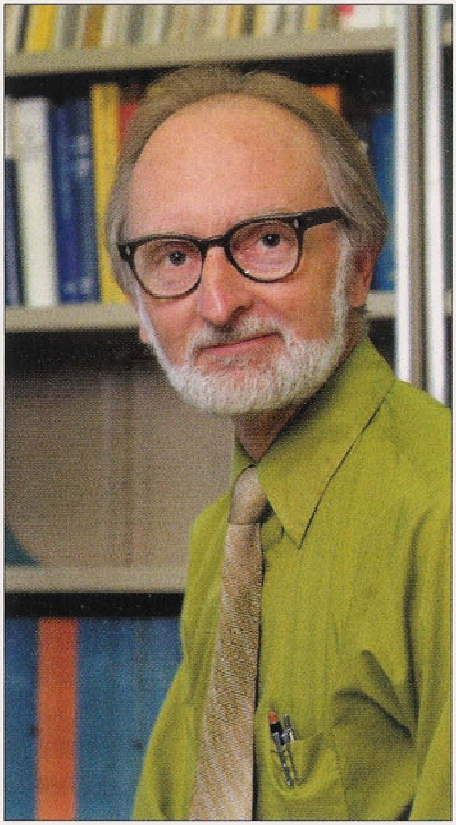
Owen Chamberlain 1920–2006

Owen Chamberlain, who shared the 1959 Nobel Prize for the discovery of the antiproton, passed away quietly in his home in Berkeley, on 28 February 2006, following a long struggle with Parkinson's disease. He was 85. Chamberlain, an emeritus professor of physics at the University of California, Berkeley, had an almost 60 year association with Lawrence Berkeley National Laboratory (LBNL).

Chamberlain, working with Emilio Segrè, Clyde Wiegand and Thomas Ypsilantis, discovered the antiproton in 1955 at the Rad Lab (now LBNL). The accelerated protons to an energy of 6 GeV, just enough to produce proton–antiproton pairs (*CERN Courier* November 2005 p27). Chamberlain and his collaborators used a magnetic spectrometer to select fixed-momentum particles from proton–copper collisions. Two scintillation counters were used to measure the time of flight over a 10 m flight path. The time-of-flight system was supplemented with two Cherenkov counters, also to measure velocity. The combined Cherenkov identification and time-of-flight velocity measurement provided the 40 000 to 1 rejection factor needed to separate single candidate antiprotons from background particles, mostly negative pions and kaons. An expanded collaboration later used a stack of emulsion to confirm the discovery.

Chamberlain was born in San Francisco on 10 July 1920, the son of W Edward Chamberlain, a prominent radiologist who had a strong interest in particle physics, and Genevieve Lucinda Owen. His family moved to Philadelphia in 1930. After obtaining a bachelor's degree from Dartmouth College in 1941, Chamberlain entered graduate school at UC Berkeley.

In early 1942, at the prompting of Ernest Lawrence, Chamberlain joined the Manhattan Project, the effort to build an atomic bomb. In



Owen Chamberlain, emeritus professor at UC Berkeley, who died in February aged 85.

Berkeley, and later in Los Alamos he investigated nuclear cross-sections for intermediate-energy neutrons and the spontaneous fission of heavy elements. After the war, he returned to graduate work at the University of Chicago to study under Enrico Fermi. Chamberlain's doctoral project was a study of the diffraction of slow neutrons in liquids. After receiving his PhD in 1948, he returned to UC Berkeley and began his research at the Rad Lab, initially studying proton scattering on various targets. This included some of the first experiments with polarized-proton beams.

Chamberlain's later research covered a variety of fields. After the antiproton discovery, he went on to study antiproton interactions in hydrogen, deuterium and other elements, and then observed antineutron production from antiproton interactions.

In the early 1960s, Chamberlain pioneered the application of polarized targets to high-energy physics. He spent much of the next 20 years using polarized targets to study spin physics and other topics. This included notable early experiments on the parity of the Σ baryon, and tests of time reversal. He did this work at a variety of accelerators, including the LBNL 184 inch cyclotron, the Bevalac, accelerators at SLAC and Fermilab and others.

Even later in life, he continued his hands-on work. In the late 1970s and early 1980s, he worked on the high-voltage field cage for the SLAC/PEP-9 Time Projection Chamber; this required considerable study of material properties. Despite ill health, after retirement, he maintained his interest in physics, often appearing at seminars and colloquia.

In his later years Chamberlain became an outspoken activist for nuclear-arms control and other issues of social concern. In the 1960s he supported the Free Speech Movement at UC Berkeley, and strongly advocated increased minority recruitment and enrolment there. He spoke out against the repression of scientists in the former Soviet Union, demonstrated against the Vietnam War and was a founder of the nuclear-freeze movement of the early 1980s.

"As a Nobelist, I'd been made prominent and well known," he once said in an interview. "My advice was sought in a number of areas and I felt a responsibility to speak up on important issues."

Spencer Klein and Lynn Yarris, Lawrence Berkeley National Laboratory.

Owen's Bodega Bay Workshop on Polarizing Antiprotons

I will talk about a Workshop that brought together two of Owen's lifelong physics interests: antiprotons and polarization. The Workshop occurred at Bodega Bay in April 1985. However, the idea for the Workshop started at the September 1984 SPIN Symposium in Marseille France; Owen, Ernest Courant, and I were at a swimming pool over looking the Mediterranean.

Owen started telling us about his recent visit to van de Meer's antiproton accumulator ring, which allowed one to store and then collide high-energy beams of antiprotons in the CERN SPS. He told us how amazed he was that one could now store high-intensity beams of antiprotons; accelerate them to hundreds of GeV; and then collide them. He recalled that he and Segre had to wait hours to see a single antiproton. Then we all went swimming; Owen was thin and frail; I easily beat him during the first few laps. However, I involuntarily quit after four laps, while he continued for six more laps.

After we got dry, recalling his amazement at CERN's antiproton Collider, Owen suggested that perhaps one should try to polarize antiprotons. This led to much discussion, but it was soon clear that none of us had any idea of how to do it. However, as senior members of the Spin Mafia, we felt that we should try. Ernest said that he did not know much about antiprotons; I shared his lack of knowledge, but agreed to help Owen organize a long-weekend workshop on polarizing antiprotons, at some isolated spot near Berkeley.

Since we no idea how to polarize antiprotons, we decided to encourage crazy ideas and included a request for "crazy ideas" in the invitation letter. To further encourage crazy ideas we agreed to each give an introductory talk with a very-crazy idea to encourage others to present slightly less crazy ideas.

Bodega Bay lies 68 miles north of San Francisco on the spectacular Sonoma Coast. Located between the Russian River to the north and Tomales Bay and the Point Reyes Peninsula to the south, this unspoiled coastal region was chosen by artist Christo for his famous Running Fence and Alfred Hitchcock for the filming of "The Birds." It is the home of the busiest commercial fishing fleet between San Francisco and Eureka.

Now we move forward 8 months to Bodega Bay California in April 1985. Twenty-one physicists from many possibly relevant areas had gathered at the isolated and very nice Bodega Bay Lodge, which was very competently arranged by Jeanne Miller. One problem was that there were 21 physicists and 20 available rooms; this occurred because Dan Kleppner of MIT telephoned me with a last-minute request to invite a young physicist from Washington named Jerry Gabrielse (that MIT was trying to hire). I immediately telephoned Owen and Jean with this request. Owen enthusiastically supported inviting him. However, Jeanne pointed out that there were 20 rooms and we already had 20 participants; Owen immediately responded that perhaps he or I could share our room with this smart young physicist. I then succeeded in saying nothing for several minutes; Owen then volunteered to share his room and did. Gabrielse later went to Harvard and used the CERN Antiproton Accumulator Ring to make the world's first anti-atoms and has done beautiful atomic physics experiments with them. I hope he appreciates the help he received from Dan Kleppner and Owen.

The Workshop Agenda split us into 5 five working groups on different possible efforts. Van der Meer first reviewed the status of CERN's Antiproton Accumulator. Then all five Working Group Coordinators, including Owen and me, each reviewed some possible techniques in their area. Owen spoke on his "crazy idea" of using a variation of van der Meer's stochastic cooling to monitor the polarization of each proton bunch as it passed one side of the ring and then send fast signals to the other side of the ring with instructions: be nice to the protons with a good polarization and to be mean to those with a bad polarization. During Owen's talk, van der Meer looked very unhappy and started working fiercely on some calculations. When Owen's talk ended, van der Meer asked for permission to respond. He said very politely that Prof. Chamberlain's idea was very interesting, but it had one small problem. He then showed his calculations indicating that Owen's signal to noise ratio was 10^{-42}; Owen was slowly sliding down in his chair as van der Meer progressed. Owen clearly beat me in proposal craziness level; my proposal was a moving Dynamic Nuclear Polarization idea with microwaves transferring the polarization of a polarized electron beam to an antiproton beam with exactly the same velocity. My idea was quickly demolished by Carson Jeffries and Dan Kleppner, but only by a factor of about 10^{-9}.

Fortunately, some of the other ideas did work to some extent. Aki Yokosawa's idea of catching the polarized antiprotons from the decay of a high-energy beam of naturally-polarized anti-hyperons was implemented at FermiLab; the intensity was rather low, but they made a beam of 200 GeV polarized antiprotons and did some nice experiments with them. Erhardt Steffan's spin filter idea was tested at the small Max Planck ring in Heidelberg and produced a few % polarization; this idea may be carried on by a team from COSY-Jülich working at the new FAIR facility being built at GSI-Darmstadt. Thus, Owen's crazy Workshop did bear some fruit.

STOCHASTIC POLARIZATION

(IF HE CAN DO IT
I CAN DO IT.)

A. [redacted] SIGNAL SAYS
A GROUP OF PARTICLES
HAS REVERSE POLARIZATION:

B. SOME DEVICE REVERSES
THESE SPINS.

C. AS BEAM CIRCULATES IN
MACHINE, NEW GROUPS OF
PARTICLES ARE STUDIED.