

Tribute to Dick Post on His 90th Birthday

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Abstract Richard F. (Dick) Post, who began his fusion career in 1951, has been one of the most creative and prolific scientists in the world fusion program. In this essay, fellow fusion scientist Ken Fowler pays tribute to Dick's multi-decade contributions.

Keywords Fusion · Magnetic mirrors

Richard F. Post turns 90 on November 14, 2008. If not on that special day, then soon before or soon after, I am sure I will find him in his office at Livermore, working away at some new research idea, as he has always done, longer than I have known him, and I have known him for 50 years. Maybe the new idea will be a new wrinkle on stabilizing Maglev trains. But likely as not, some time in our conversation, the topic will turn to fusion mirror machines.

Dick was introduced to fusion research through lectures by Herb York, who was the first Director at what is now the Lawrence Livermore National Laboratory. Eager to get Livermore into controlled fusion research, Herb had thought RF pressure could confine plasmas and he set Dick up as head of an experimental group to try this. Dick and his colleagues soon realized that was a tough go and began to focus on RF as an enhancement of confinement when plasma ions encounter a strong magnetic field, the magnetic mirror phenomenon known from cosmology. Dick's first experiment to demonstrate mirror confinement in the laboratory, in 1952, consisted of ECH applied to a meter-

long pyrex tube inside a solenoid with stronger coils at the ends.

There are so many things to remember Dick for in the world of mirror fusion, not the least being his recent invention of kinetic stabilization of circular mirror machines otherwise subject to MHD instability, and its application to the Kinetically Stabilized Tandem Mirror (KSTM) [1]. I have looked at Dick's KSTM idea myself, and find it really makes all the difference in the outlook for tandem mirror reactors, as compared with our original concept using the Yin Yang version of minimum-B mirror coils as "end plugs." Poetic justice, since it was Dick who co-invented the Yin Yang in the first place. Dick also invented Direct Conversion, to make electricity by fusion without steam.

Fred Coensgen used Dick's Yin Yang design for his classic 2XIIB mirror experiment that was the first fusion experiment of any kind—magnetic or inertial—to reach thermonuclear temperatures in 1975. Dick wrote a wonderful summary of that experiment and all early mirror experimental work in the book edited by Edward Teller in 1981 [2]. Actually, it was Dick's idea about stabilizing loss cone instabilities that made 2XIIB work. For those who do not remember, loss cone instabilities are the special curse of mirror confinement, one of the most important modes being the DCLC that Dick (among others) had uncovered theoretically, in a paper published in collaboration with Marshall Rosenbluth in 1966 [3]. By the time I arrived to work at Livermore in 1967, Dick had already figured out how to stop the DCLC mode, by introducing enough "warm plasma" to partially fill the loss cone. Ioffe in Russia heard about this, tried it, sent word that it worked, and Coensgen built a stream gun to supply warm plasma in 2XIIB.

Dick and I carpooled in the gas crisis of the 1970s. It was like a seminar, in which we threshed out many ideas,

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including the beginnings of the tandem mirror. It was in carpooling also that I learned about Dick's interest in electric cars. He and his son Steve published this in *Scientific American* [4], proposing flywheel energy storage using space-age fiber composites that could spin at very high speed, and a specially-designed electric motor that could deliver 100 horsepower in a device the size of a fist. Later a company produced such flywheels, though the automotive application has not yet caught on. Flywheel storage also required essentially-lossless bearings, for which Dick proposed stabilized magnetic bearings of his own devising. I recall our playing with ceramic magnets on his living room rug as he thought this through. He is still involved in stabilized magnetic flotation, for Maglev trains, via General Atomics [5].

How do you appreciate a unique individual like Dick Post?

One day at a time. Happy birthday, Dick!

Richard Freeman Post was born in Pomona, California. He received his B.A. from Pomona College in 1940 and a Ph.D. in Physics from Stanford in 1950, with intervening years at the Naval Research Laboratory. He also received an honorary Sc.D. from Pomona. In 1963, he was appointed Adjunct Professor in the Department of Applied Science, University of California, Davis. At the Lawrence

Livermore National Laboratory, he was appointed group leader in Controlled Thermonuclear Research in 1951 as the lab was being founded; then Deputy Associate Director for Magnetic Fusion Energy in 1974 and Senior Scientist in 1987. He has thus far authored over 25 patents in fusion, accelerators, electronics and mechanical energy storage. He is a Fellow of APS, ANS and AAAS. His many fusion honors include the ANS Outstanding Achievement Award in 1977, the APS James Clerk Maxwell Prize in 1978 and the FPA Distinguished Career Award in 1987. His magnetics work has been recognized by a *Popular Science* Design and Engineering Award for passively stabilized magnetic bearings in 2000 and an R & D 100 Award for Induc-Track (Maglev) in 2004.

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