Research Statement

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At present I am working full-time on the SNAP (Supernova / Acceleration Probe) satellite project. I work closely with Saul Perlmutter in defining the scientific and technical requirements for this experiment and heavily involved in the effort to propose and fund the project. A serve as the co-PI on this project with Saul and am the Project Director – responsible for the technical and operational management. Furthermore, I have the added responsibility of SNAP group leader at LBNL, so am responsible for budget, hiring, and personnel supervision within the LBNL group.

Prof. Perlmutter and I were recently awarded a $2.38M three year grant from the Gordon and Betty Moore Foundation in support of the Supernova Factory experiment to facilitate the cataloging and dissemination of scientific results from that program.

From 1998 onwards I led a research group developing optical detectors to be used on supernova instrumentation and for SNAP. This group develops the devices (CCD's – charged coupled devices) at our MicroSystems Laboratory and we are responsible for making, testing, packaging, and deploying these devices on a number of ground based telescopes.

Until recently, I was a participant in the BaBAR experiment in operation at the Stanford Linear Accelerator Center. I led and supervised a group of physicists, engineers, and students in developing the electronics for the BaBAR experiment. My group provided two major electronics items; they were: 1) the drift chamber readout circuit, and 2) the charged track trigger. Both items were major experimental developments. I also developed the concept for the silicon vertex detector based upon Monte Carlo simulations of the data and participated in the development of the readout chip for the vertex detector.

Between mid-1989 and 1993 I was engaged in a research project to develop high density front-end electronics for the SDC calorimeter at the superconducting supercollider. As principal investigator of this project at LBL I supervised several engineers, established research direction, and proposed and obtained funding. During the summer of 1989 I presented a series of lectures at the SLAC Summer Institute on the Higgs boson and the discovery potential for it at the SSC. In 1990 I joined the Solenoidal Detector Collaboration.

From 1986 to 1989, as a member of the MarkII collaboration, I was PI and project manager of a project to measure the SLC beam energy to high precision. The project constructed over 600 feet of extraction-line and optics which guide the spent beams from the interaction point to high resolution spectrometers. This measurement was crucial to the determination of the Z^0 mass, width, cross-section, and the number of light neutrino species, and I actively participated in the analysis of this data. I proposed and obtained funding for this project, designed the beam-line optics, spectrometer, trigger, readout data

acquisition, and associated instrumentation, and oversaw its construction. During this period I supervised the three graduate students and one post-doc involved in this project. As part of the program we had to invent a new way to measure the beam energy which involved new detector technologies to monitor intense synchrotron X-ray beams. The spectrometers' performance exceeded expectations and enabled both the MarkII and SLD experiments to accurately measure the Z^0 mass. This resulted in major publications listed below.

From February 1984 until October 1985, I worked as a CERN scientific associate with the UA1 experiment on the pp-bar collider under the direction of Prof. C. Rubbia. The data analysis I performed was concerned with the production and decay of the weak intermediate vector bosons, and associated jet production. I was a member of the small working group responsible for the discovery and analysis of the decay $W \rightarrow \tau\nu$. I participated in the analysis and background studies for events with large missing energy. I was also involved with the measurements of the mass and width of the Z^0, and with measurements of the $W^{\pm}$ production properties (such as the differential cross-sections, quark structure functions, and associated jet activity). These analyses have resulted in a number of publications listed below. I also participated in the testing and installation of an upgrade to the central detector electronics involving high-speed gated MECL arrays to permit simultaneous data collection and event read-out. I was also involved in the development of microcode for a FASTBUS readout controller to be used for a proposed high resolution small radius drift chamber.

As a graduate student at U.C. Berkeley, beginning in September 1977, I worked under the supervision of Prof. G. Trilling on the MarkII experiment while it was installed on the SPEAR e^+e^- storage ring at SLAC. There, I developed a pattern recognition program which was later to be used for track finding by the MarkII detector at PEP. After two years at Berkeley I transferred to the graduate program in physics at Harvard as a thesis student of Prof. R. Schwitters. I continued to work on the MarkII experiment after it was moved to the PEP e^+e^- storage ring at SLAC. I shared responsibility for the maintenance and repair of the MarkII drift chamber, including the high voltage, electronics, calibration and read-out. Following an interest in the problem of track recognition I developed and implemented a high speed, geometry independent algorithm for track finding. For my dissertation I performed and published a measurement of the neutral current couplings in the processes $e^+e^- \rightarrow e^+e^-(\gamma)$, $\rightarrow \mu^+\mu^-(\gamma)$, and $\rightarrow \tau^+\tau^-(\gamma)$. In addition I performed and published a measurement of the inclusive charged branching fractions of the τ lepton. This publication was the first precision measurement of the inclusive decay modes of the τ. I also participated in lifetime studies of long-lived particles using a high resolution vertex detector.

In early graduate school I acquired additional laboratory experience during summers spent at the Space Sciences Division of the Naval Research Laboratory in Washington, D.C. under the supervision of H. Friedman. I was fortunate to have worked on a small sounding rocket borne x-ray experiment and participated in construction, launch, and recovery.

During my senior year at Harvard, as a research assistant for Profs. L. Sulak and C. Rubbia, I worked on the construction and installation of large area drift chambers for use in a neutrino scattering experiment at Brookhaven Laboratory to measure $\sin^2\Theta_w$. I also developed low noise preamplifiers for underwater hydrophones to be used in the proposed DUMAND project.