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A Career from Nuclear Physics in Academia to Semiconductor Technology in Industry

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In the late 1970s and early 1980s, the integrated-circuit industry was revolutionized by the development of robust field-effect transistor (FET) implementations. Bipolar-junction-transistor (BJT) circuits were not completely replaced, but FETs, especially in the form of complementary-metal-oxide-silicon (CMOS) technology, provided a superior path to higher levels of device integration. For many years, the "driver product" for CMOS technology R&D was memory, especially dynamic-random-access memory (DRAM). The pace of this development was approximately 4 times the number of bits/chip every 3 years, about equally enabled by decreasing device dimensions and by increasing chip size, both requiring continued advances in lithography and other process technologies. The competitive pressure for achieving the associated breakthroughs provided an attractive industrial laboratory environment for quite a few physicists in this era. The technical challenges tended to be interrelated both within and between semiconductor-device and thin-film process design, requiring simulation as well as experiment. Today, electrical engineering has matured to the point that many EE PhDs are educated in these areas. However, 3-4 decades ago, quite a few academic physicists (even a few from nuclear physics!) followed this opportunity into industrial semiconductor physics and helped lead the revolution toward modern nano-electronics. The integrated-circuit industry is one of many that continue to hire physicists into the teams that address current R&D challenges. Hopefully, there will always be opportunities for physicists to "catch waves of various amplitudes" in industrial research. Note that these opportunities include collaboration with industry, an area in which the academic physics community might further adopt a few best practices from their engineering colleagues.