

Silicon is for Physics what carbon is for life

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Introduction: technological developments have become the basis for progress in the understanding of the world around us, more effectively than the ancient philosophical approach. From the Galilei telescope and the microscopes of Antony van Leeuwenhoek onwards, the inventions of scientific instruments led to discoveries in electricity, magnetism, light, cryogenic behaviour and numerous other phenomena. In return, this led to practical applications and further technological innovation. This technology/science spiral continues to open new ways to achieve ever deeper understanding of elementary particles. The subject of the lecture is the exploitation in physics of the micro-, nano- and pico-technologies based on silicon that are being developed for electronics and mechatronics. In the evolution of life, the element carbon has been preferred for a much broader range of structures, but progressively a wide variety of devices is now being created thanks to the amazing properties of the element silicon. A few other applications in science will be mentioned, such as chips with nanopores for DNA sequencing or CCD for astronomy. In future particle physics experiments, the silicon detectors could feature micron-size voxels using nanometer readout circuits. Such detectors will have improved precision in position and time measurement, and they can also record energy depositions well below a keV.