After 40 Years of Integrable Quantum Electronics: Quo vadis QE?

Prof. Dr. habil. Jörg Schulze, Universität Stuttgart

Abstract:
Since the discovery of the Germanium Tunneling Diode 1957 by Leo Esaki – awarded with the Nobel Prize in Physics 1973 – the idea of quantum-based electronics was entering the world. And with Shor´s publication of his integer factorization algorithm in 1994 the dream to build a "Quantum Computer" was born. But if we have a look at the real, Silicon-dominated development of electronics since the 1960s it is not "Quantum" what we will find, it is „Moore´s Law" of the exponential growth rates of „classical" electronics.

Gordon E. Moore postulated his „Law" 1965 after his observation, that the number of transistors per integrated chip increased accidentally by the factor 4/3 p.a. during the time period 1959-1965. This was obtained by an appropriate stepwise scaling of the geometrical dimensions of the transistors. The short version of this "Law" says: "… that there are currently (1965) no technical reasons, why this growth, this scaling should stop!" In retrospective (2019) we can state that this "Law" was absolute valid until 2005. But now (2019) we reached (quantum-)physical limits stopping this growth and therefore the "Law".

Is this now the time for quantum electronics and the "Quantum Computer" to come? And how it will look like?

The talk will pursue these questions and will discuss how quantum-based electronics developed, grew, established – outshined a bit by „classical" Moore-driven electronics – to finally ask: Quo vadis, Quantum Electronics?