

Prize Talk PV VII Wed 11:45 V53.01
The quantum way of doing computations — ●RAINER BLATT
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Since the mid nineties of the 20th century it became apparent that one of the century’s most important technological inventions, computers in general, and many of their applications could possibly be further enormously enhanced by using operations based on quantum physics. Computations, whether they happen in our heads or with any computational device, always rely on real physical processes, which are data input, data representation in a memory, data manipulation using

algorithms and finally, the data output. Building a quantum computer then requires the implementation of quantum bits (qubits) as storage sites for quantum information, quantum registers and quantum gates for data handling and processing and the development of quantum algorithms. In this talk, the basic functional principle of a quantum information processor will be reviewed and the ion trap technology for its implementation will be highlighted. In particular, quantum information processing will be illustrated by showing how entanglement is generated and used for computational processes. Aside from their use as quantum computers, such quantum information processors open wide perspectives for applications in many research areas. Examples will be presented for quantum enhanced metrology and quantum simulations.