UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Niederdimensionale Halbleitersysteme I

SS 2013

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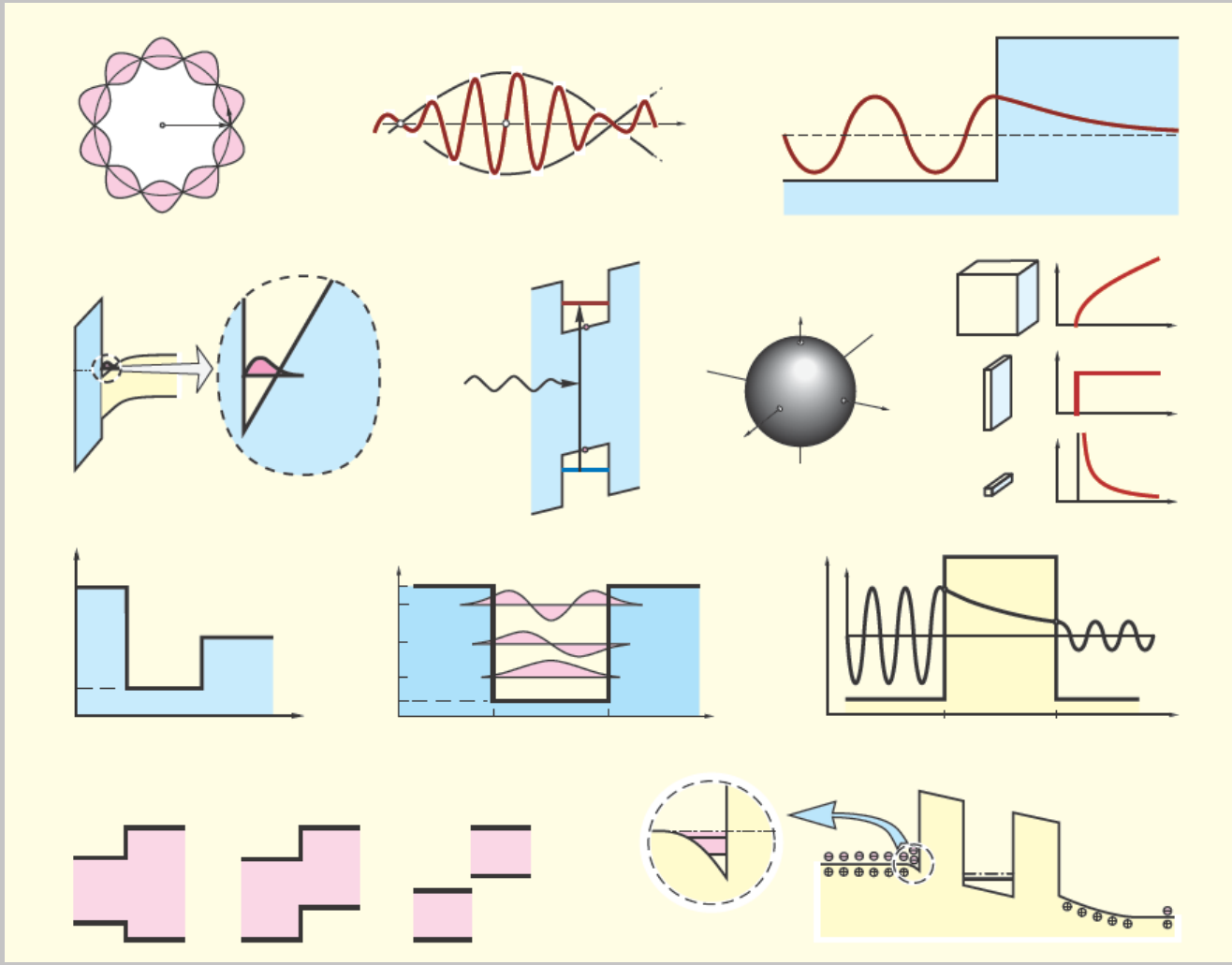
Einleitung

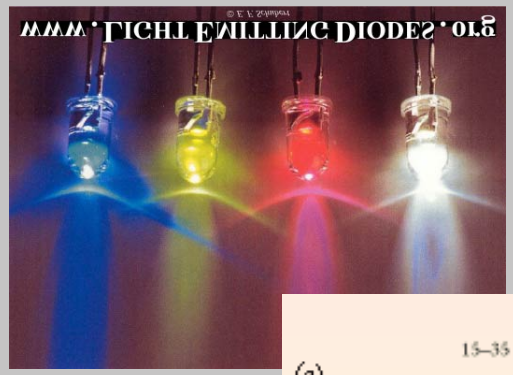
- Niederdimensionale Halbleiterstrukturen - Nanostrukturen
- Physik von 3-, 2-, 1- und 0-dimensionalen Strukturen
- Quantum Wells (QWs)
- Optische Prozesse in QWs
- Superlattices und gekoppelte QWs
- Modulationsdotierte QWs und HJ
- Tunnelströme
- Quantum Wire und Quantum Dots

Niederdimensionale Systeme



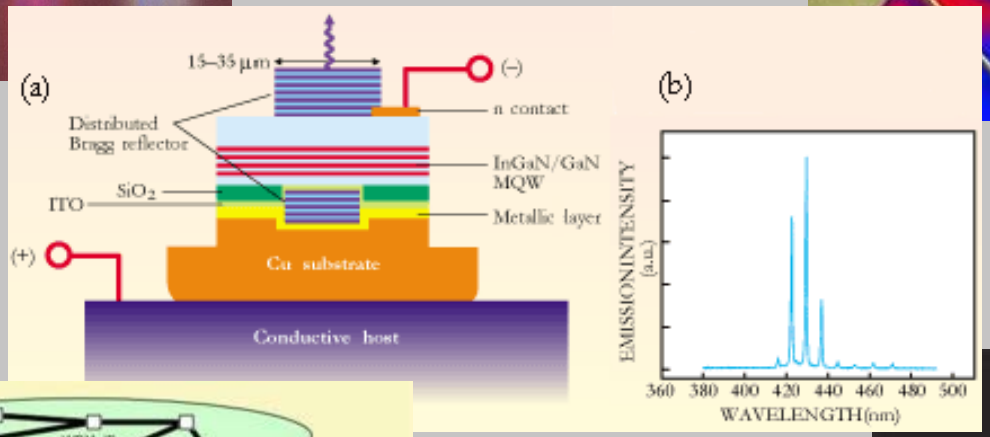
Optoelectronic Devices

LEDs

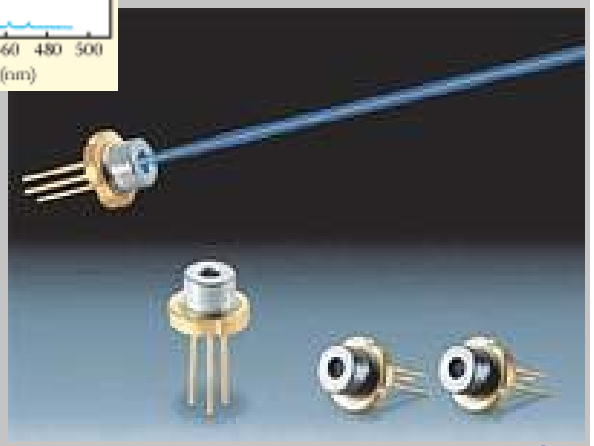


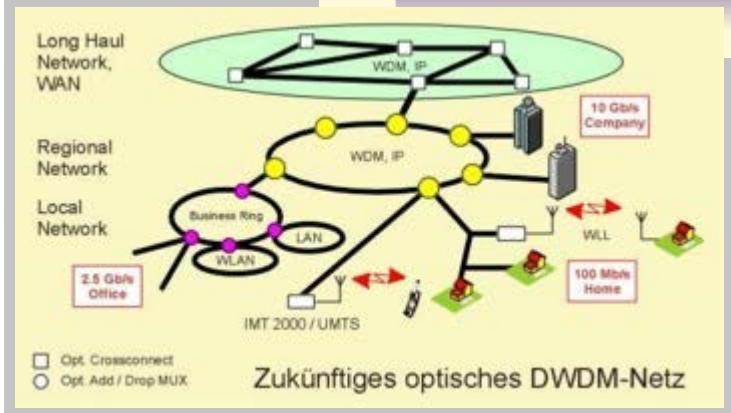
Detektor

RCLEDs



Laser





Transistor

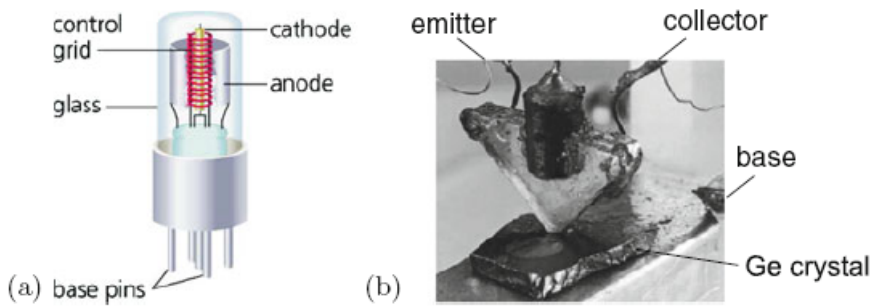


Fig. 23.1. (**a**) Schematic image of a vacuum triode. The electron current flows from the heated cathode to the anode when the latter is at a positive potential. The flow of electrons is controlled with the grid voltage. (**b**) Bell Laboratories' first (experimental) transistor, 1947

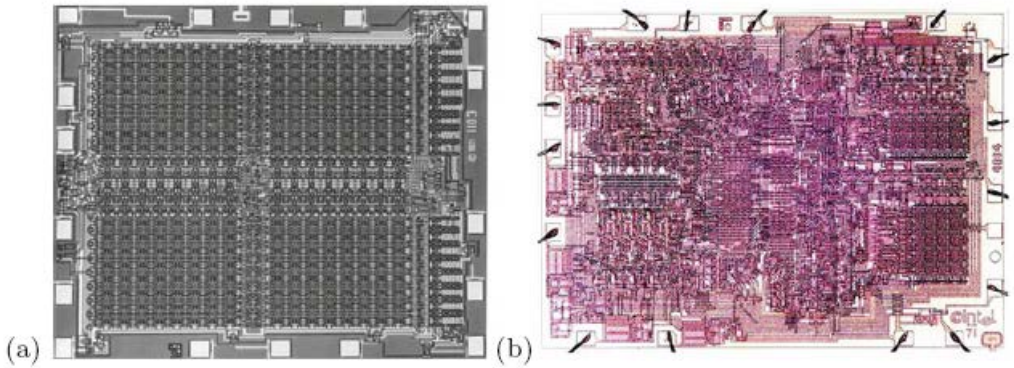


Fig. 23.29. (**a**) Intel™ 1103 1 KByte (1024 memory cells) dynamic random access memory (RAM), arranged in four grids with 32 rows and columns (1970), chip size: 2.9×3.5 mm^2. (**b**) Intel™ 4004 microprocessor (1971), chip size: 2.8×3.8 mm^2, circuit lines: 10 µm, 2,300 MOS transistors, clock speed: 108 kHz

Interated Circuit

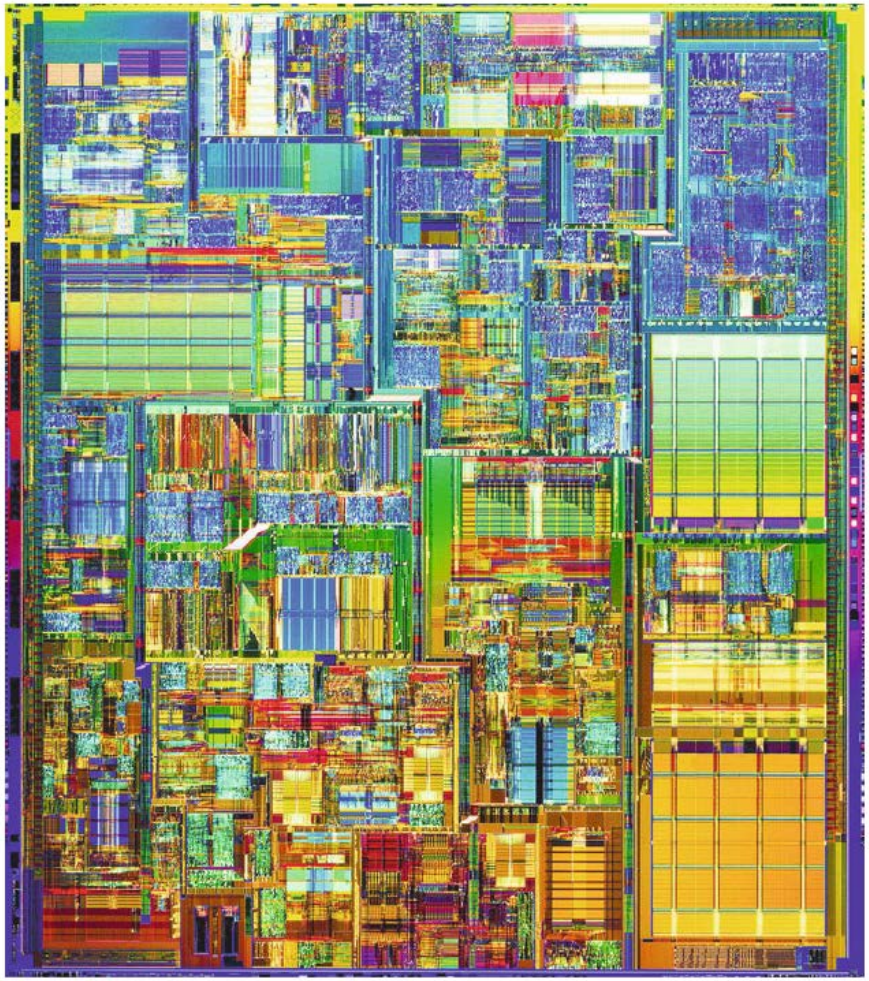


Fig. 23.30. The Intel™ Pentium 4 microprocessor (2000), circuit lines: 0.18 µm, 42 million transistors, clock speed: 1.5 GHz

Literatur

Nanostructures:

J.H. Davies,	"The Physics of Low-Dimensional Semiconductors: an introduction"
M.J. Kelly,	„Low-dimensional Semiconductors – materials, physics, technology, devices"
O. Manasreh:	„Introduction to Nanomaterials and Devices"
M. Grundmann:	„The Physics of Semiconductors"
E.F. Schubert:	„Physicsl Foundations of Solid-State Devices"
F. Henneberger et al.:	„Optics of Semiconductor nanostructures"
K.H. Ploog:	„III-V quantum system research"

Allgemeine Halbleiterphysik:

S.M. Sze,	„Physics of Semiconductor Devices"
J. Singh,	„Physics of Semiconductors and their Heterostructures"
J. Singh,	„Semiconductor Devices – An Introduction"
O. Manasreh	„Semiconductor Heterojunctions and Nanostructures"
R. Waser:	„Nanoelectronics and Information Technology"

Laserdioden:

S.L.Chuang,	„Physics of Optoelectronic Devices"
J. Singh,	„Optoelectronics – An Introduction to Materials and Devices"