

OPTOELECTRONICS ON SILICON – A CHALLENGE FOR SEMICONDUCTOR PHYSICS

by Alois Krost, Armin Dadgar, (p. 3)

Since 20 years silicon as a substrate has attracted much attention for the epitaxial growth of optoelectronic III-V compounds. Besides its low price and its availability in large diameters up to 12 inches it offers the entrance in the fascinating world of integrated optoelectronics. However, in spite of the huge efforts made, no real breakthrough has been obtained so far. Major difficulties in the epitaxial growth of the conventional III-Vs (GaAs and InP) arise from the misfit dislocations and in the case of GaN from the large thermal mismatch of GaN and Si leading to cracks. We have developed three simple and promising methods to avoid cracks: strain-compensation, patterning, and the insertion of low-temperature AlN interlayers. With all methods device quality GaN can be grown. While patterning is especially interesting for light emitters, LT-AlN interlayers can be used universally not only for transistor structures, which require good insulation of the active layers to the Si substrate, but also for vertically contacted LEDs when doped with Si. LT-AlN interlayers do not only reduce tensile stress but also improve GaN properties and strongly reduce the threading dislocation density. So far, best LEDs on Si(111) have an optical output power of 0.42 mW at 20 mA and 498 nm which is enough for simple signal applications (indicator lights).

COMPUTER-SUPPORTED COOPERATION OF AUTONOMOUS MOBILE SYSTEMS

by Edgar Nett, (p. 11)

Handling the always increasing traffic by building new roads and highways will sooner or later meet its natural limits. Therefore, it is of utmost importance for the economy and the personal mobility that the existing road space will be used more efficiently. Mobile autonomous systems (trains, automotive, mobile service robots) are becoming more and more sophisticated and complex. The objective of ongoing research is to develop an inter-vehicle communication platform that enables reliable and timely cooperation for the benefit of the vehicle passenger's safety, comfort and pleasure. This article exhibits some of the most challenging research problems and explains some approaches attempting to contribute to their resolution.

PSYCHIATRY FROM A NATURAL SCIENTIFIC POINT OF VIEW

by Bernhard Bogerts, (p. 17)

During the last centuries, the search for causes of mental disorders was dominated for a long time by moralizing theories arguing that „madness“ was a result of a vicious and sinful lifestyle or a work of the devil himself. Since about 1900, the discovery of organic brain changes underlying aphasia (loss of speech) and of frontal brain syndromes, that are associated with profound changes in personality, led to an increasing acceptance of the view that disorders of the mind have a neurobiological basis. The introduction of the first antipsychotic and antidepressive drugs in the years 1952 and 1957, respectively, changed dramatically the hitherto ineffective therapeutic situation and improved considerably the outcome of various psychiatric disorders. In the last twenty years, neurobiological abnormalities in schizophrenia have been found leading to a better understanding of the pathophysiology of this enigmatic disease. Therapies of all psychiatric disorders are most successful if psychopharmacological and psychotherapeutic strategies are applied simultaneously. From a clinical point of view it is justified to assume, that somatic and psychological therapies act on lastly identical intrapsychic/neurobiological processes.

FROM INTERDISCIPLINARY BASIC RESEARCH TO APPLICATION IN COMPUTATIONAL VISUALISTICS THE MAGDEBURG ENDEAVOUR TOWARDS

A UNIFIED IMAGE SCIENCE

by Klaus Sachs-Hombach, Jörg R. J. Schirra, (p. 27)

Since early cave paintings, pictorial representations have been assigned an always controversial but nevertheless indispensable orientation function. Exercising this function, pictures have often entered into competition with words. Pictures were considered as inferior to words with regard to expressing abstract thoughts, but in compensation to that an almost magical aura has been attributed to them. As a result of this ambivalent attitude towards pictures, all inventions of novel pictorial media have evoked both greatest enthusiasm and utmost skepticism. This attitude is probably also responsible for the fact that up to now a unified and, in a stricter sense, scientific research on pictures could not be established. In the following article the endeavours undertaken recently to establish such a research at University of Magdeburg are described. Combined with this description we would like to present our own proposal for a conception of image science.

CONFRONTATION, COMPETITION, OR COOPERATION?

by Michael Pauen, (p. 39)

The stunning successes in neuroscience and information technology raise new philosophical questions. Any serious discussion of these problems requires an intense cooperation of science and the humanities, particularly philosophy. Two examples are discussed. First, any assessment whether or not human intelligence or even consciousness might be realized by an artificial system requires a thorough philosophical analysis of what we mean if we talk about „intelligence“ or „consciousness“. Second, philosophical considerations concerning the problem of free will can demonstrate that, despite appearances to the contrary, freedom and determinism might be compatible.