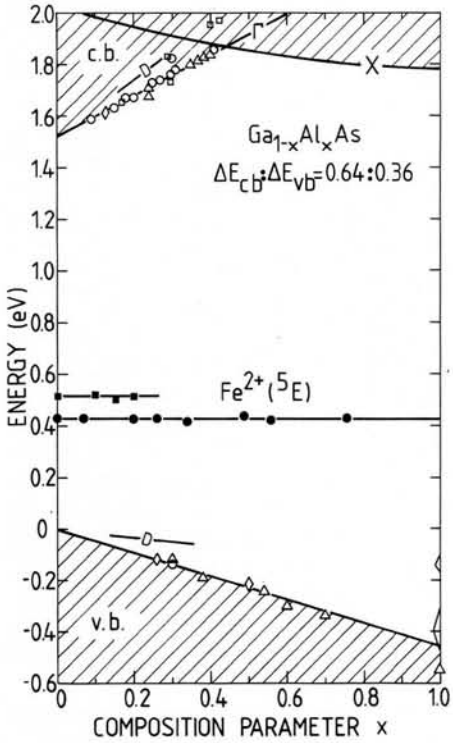

The $Ga_{1-x}Al_xAs$ band edges compositional evolution as obtained assuming that the Fe^{2+} acceptor level may be used as a reference (internal "vacuum level"). The agreement between the predicted slopes and measurements of band edge discontinuities in GaAs/GaAlAs heterostructures (open points) is striking (see ref. 7 for further details).

ture in all spin-sensitive experiments. The theory, although very much progressing in the last few years [6]), is still in its evolutionary stage. It must explain a puzzling dichotomy of the properties of this group of centres. Some of them (like a multitude of the charge states in a gap, the relatively large crystal-field splittings or the significant reduction of the spin-orbit coupling) indicate strong hybridization of the impurity d states with the host and a reduction of the electron-electron interaction, while others (like the atomic-like multiplet structure of the impurity levels, a strong d^5/d^4 stabilization and relatively small Jahn-Teller effects) may indicate the opposite. The source of this dichotomy, as suggested recently by Zunger [6]), is a much weaker screening of the exchange attraction compared with the Coulomb repulsion.

A still relatively large *U* in this group of impurities explains a bizarre connection discovered recently between the transition-metal energy levels in semiconductors and the energy-band offsets in semiconductor heterojunctions [7]). It was found that these levels behave as a reference for the semiconductor bands. The difference in their energy position in the two isovalent semiconductors provides a direct estimate for the valence (or conduction) band offset in a heterojunction made of this pair of semiconductors (Fig. 1).

Research Trends and Perspectives

One of the strongest driving forces for research in the field is undoubtedly the semiconductor industry. A further miniaturization of solid state devices will exert even stronger pressure, since the role of deep-level defects introduced purposely, or already existing in the material or even introduced during processing, increases dramatically with a reduction in the active volume of a device. The reason is the control they exercise over lifetime in concentrations that can be extremely low. Consequently, the inevitable variations in density that occur, will be reflected in wide variations in the dynamic properties of devices as they become smaller.

A key question addressed to physicists studying the properties of deep-level centres concerns the microscopic nature of defects influencing properties of the host materials as well as of devices made either on or from them. Identification is therefore the key problem. In spite of a very large effort there are only very few defects, whose chemical identity and dynamic properties have been determined with satisfactory precision. Unfortunately no single tool or analytic prescription on how to achieve this goal exists. Usually many different techniques combined with strong theoretical effort must be used. Bulk measurements like Hall effect have been almost replaced by much more sensitive junction techniques. Also microwave spin resonance techniques like ESR or ENDOR have successfully been combined with optical excitation. These techniques adopted largely from atomic physics have become the main identification tools [8]).

Substantial progress in the microscopic theory of defects has made theoretical calculations and modelling a true and indispensable partner in defects research. The best example of this interplay has already been mentioned in the context of a negative-*U* silicon vacancy. One of the preconditions of a successful attempt at a theory of deep-level centres is the availability of a comprehensive description of the host semiconductor: its band structure and the crystal structure. Such a stage has been achieved just recently owing mainly to progress in computational tools. It is interesting to note, however, that in parallel with weighty computational efforts, much simpler semi-empirical models have been recently developed to track the chemical trends [10]). Their predictive credibility could not however, have been tested, without these much more elaborate and less transparent supercomputer calculations.

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A most recent review of various aspects of the deep-level research can be found in the book *Deep Centers in Semiconductors*, ed. S. Pantelides (Gordon and Breach, New York) 1986 as well as in a long review by Blakemore J.S. and Rahimi S. in *Semiconductors and Semimetals* **20** (1984) 233. Also the *Proceedings of the biannual conferences on Defects in Semiconductors* (the last published in *Mat. Sci. Forum*, Vols. 10-12 (1986)) are excellent sources.

AMP BOARD

Professor J. Los has retired as Secretary of the **Atomic and Molecular Physics Division** and at the last Board meeting held in Brighton in July he was warmly thanked for his generous help. At the same meeting it was suggested that Professor H. Erhardt of Kaiserslautern University (FRG) be asked to serve as interim Secretary pending the next election of Board members that will take place in 1989. Prof. Erhardt has accepted and agreed to bring his experience and judgment to the services of the Board until 1989.

The next General Conference of our Division, ECAMP III, will be held in Bordeaux, France, in the Spring of 1989 and colleagues from the Soviet Union have agreed to undertake the organisation of ECAMP IV in Riga some time in the late Spring of 1992.

F.A. Gianturco
(Chairman of the AMP Division)