

3rd International Conference on Modulated Semiconductor Structures

53.632083
- 61.3
1987(3)

JOURNAL DE PHYSIQUE

Tome 48

Colloque C5, supplément au n° 11

Novembre 1987

3rd International Conference on Modulated Semiconductor Structures

6-10 July 1987
Montpellier (France)

Edited by : A. RAYMOND
P. VOISIN

Avenue du Roggau,
Zone Industrielle de Courtabœuf,
B.P. 112,
F-91944 Les Ulis Cedex, France

SPONSORS

Bull

Centre National d'Etudes des Télécommunications

Centre National de la Recherche Scientifique

Chambre Régionale du Commerce et de l'Industrie

District Urbain de l'Agglomération de Montpellier

Direction des Recherches, Etudes et Techniques

IBM France

Institut Universitaire de Technologie de Montpellier

Laboratoires d'Electronique et de Physique Appliquée

Mairie de Montpellier

Ministère de la Recherche et de l'Enseignement Supérieur

Oxford Instruments France

Riber

Siemens AG

Thomson

European Research Office, United States Army

Université des Sciences et Techniques du Languedoc

ORGANIZING COMMITTEE

**Chairman : M. Voos, Paris
Secretary : J.L. Robert, Montpellier**

G. Bastard, Paris	A. Raymond, Montpellier
C. Bousquet, Montpellier	J. Sicart, Montpellier
J.M. Dusseau, Montpellier	P. Voisin, Paris

PROGRAM COMMITTEE

Chairman : G. Bastard, Paris

M. Bensoussan, Bagneux	L. Lassabatère, Montpellier
E. Gornik, Innsbruck	J.C. Maan, Grenoble
M. Kelly, Wembley	R.J. Nicholas, Cambridge
K. von Klitzing, Stuttgart	J.B. Theeten, Limeil-Brévannes
F. Koch, Munich	C. Weisbuch, Orsay

INTERNATIONAL ADVISORY COMMITTEE

G. Abstreiter, Munich	A. Madhukar, Los Angeles
T. Ando, Tokyo	G.M. Martin, Limeil-Brévannes
M. Altarelli, Grenoble	H. Martinot, Toulouse
D. Bois, Meylan	H. Morkoc, Urbana
L.L. Chang, Yorktown Heights	H. Okamoto, Tokyo
C. Delalande, Paris	K. Ploog, Stuttgart
G. Dorda, Munich	J.C. Portal, Toulouse
J.P. Duchemin, Orsay	M. Guillec, Bagneux
L. Esaki, Yorktown Heights	A. Regreny, Lannion
J.P. Faurie, Chicago	H. Sakaki, Tokyo
C.T. Foxon, Redhill	J. Shah, Holmdel
J.P. Gaillard, Grenoble	H.L. Störmer, Murray Hill
F.J. Grunthaner, Pasadena	H. Watanabe, Kanagawa
S. Hiyamizu, Kawasaki	G. Weimann, Darmstadt
H. Kroemer, Santa Barbara	J.M. Worlock, Red Bank
	W. Zawadzki, Warsaw

PREFACE

This volume contains papers presented at the Third International Conference on Modulated Semiconductor Structures, which was held at the Université des Sciences et Techniques du Languedoc, Montpellier, France, on 6-10 July 1987. The papers were reviewed, and revised when necessary : we wish to thank the referees and the authors for their involvement in completing this volume in a relatively short time.

The conference was organized by a committee consisting of G. Bastard, C. Bousquet, J.M. Dusseau, A. Raymond, J.L. Robert, J. Sicart, P. Voisin and M. Voos, with the help of a program committee and the advice of an international advisory committee. The members of these committees are listed on the previous page.

As the earlier conferences held in Pasadena, December 1982 (Journal of Vacuum Science and Technology Vol. B1(2)) and in Kyoto, September 1985 (Surface Science Vol. 174), MSS III aimed at providing a forum for the communication and discussion of updated information in the fast moving field of epitaxial growth, characterization of the structural and electronic properties, and applications of semiconductor heterostructures. The conference was attended by 255 physicists from 18 countries, representing most of the research groups active in the field. Fourteen invited papers and 130 contributed papers (including both oral and poster presentations) were presented. These contributions demonstrated both the sustained interest in the traditional scopes of the conference such as growth, characterization and optical properties of a variety of systems (including the newly grown heterostructures of semimagnetic II-VI compounds), and the rapid development of relatively new fields like sub-picosecond time resolved investigations and sophisticated tunneling heterostructures.

Finally, on behalf of the participants, we wish to thank all the sponsors of MSS III for their essential financial support to the conference.

August 1987
A. Raymond
P. Voisin

LIST OF PARTICIPANTS

- ABSTREITER, G.- Technische Universität, Physik Abteilung, D-8046 Garching
- ADDE, R.- CNRS, 15, Quai Anatole France, F-75700 Paris Cedex 07
- AIZAWA, K.- University of Tsukuba, Institute of Materials Science, 305 Sakuba-Ibaraki, Japan
- ALIBERT, C.- USTL, Equipe Microopto-electronique de Mpl, Bât. Recherche Phys., Place Eugène Bataillon F-34060 Montpellier Cedex
- ALLAM, J.- University of Surrey, Department of Physics, GB-Guildford GU2 5XH, Surrey
- ALMAGOUSSI, M.- USTL, Place Eugène Bataillon, F-34060 Montpellier Cedex
- ALTARELLI, M.- CNRS/MPI, BP 166 X, F-38042 Grenoble Cedex
- AOKI, H. - University of Tokyo, Department of Physics, Hongo 113 Tokyo, Japan
- ARAKAWA, Y.- University of Tokyo, Roppongi 7-22-1 Minato-ku, 213 Tokyo, Japan
- AUVRAY, P.- CNET, Route de Tregastel, F-22301 Lannion Cedex
- AVEROUS, M.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- AZEMA, S.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- BAJ.- Université de Varsovie, PL-Warsaw
- BARDE, P.- Oxford Instruments France, 5, Rue Aumont-Thieville, F-75017 Paris
- BARSKI, A.- Ste Riber, Division Instruments, BP 231, F-92503 Rueil-Malmaison Cedex
- BASTARD, G.- Groupe de Physique des Solides de l'ENS, 24, Rue Lhomond, F-75005 Paris
- BASTIDE, G.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- BASU, P.K.- Center Advanced Studies, Radio Physics and Elec 92, Acharya Parfullia, Chandra Road, 700 009 Calcutta, India
- BAUER, G.E.W.- Philips Research Laboratories, P.O. Box 80 000, NL-5600 JA Eindhoven
- BAUER, G.- Institut für Physik, Montanuniversität, A-8700 Leoben
- BAUER, R.K.- Technische Universität, Institut für Festkörperphysik, Sekr. PN 5/2, D-1000 Berlin
- BEERENS, J.- CNET, 196, Avenue Henri Ravera, F-92220 Bagneux
- BEN AMOR, S.- INSA, Département de Physique, 118, Avenue de Rangueil, F-31077 Toulouse Cedex
- BENHLAL, J.- GPS-ENS, T-23, 2, Place Jussieu, F-75221 Paris Cedex 05

- BENSOUSSAN.- CNET,
196, Avenue Henri Ravera,
F-92220 Bagneux
- BIEFELD, R.- Sandia National
Laboratories, PO Box 5800,
Albuquerque, NM 87111, USA
- BLEUSE, J.- Groupe de Physique des
Solides de l'ENS,
24, Rue Lhomond, F-75005 Paris
- BOEBINGER, G.- Groupe de Physique
des Solides de l'ENS,
24, Rue Lhomond, F-75005 Paris
- BOURGOIN, J.- Université Paris VII,
Groupe de Physique de l'ENS,
T-23, 2, Place Jussieu,
F-75221 Paris Cedex 05
- BOUSQUET, C.- USTL,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- BRECHET, P.- Ecole Polytechnique,
Laboratoire PMC,
F-91128 Palaiseau Cedex
- BRENNAN, K.- School of E.E.,
Georgia Technical Research
Institute, Atlanta, GA 30332,
USA
- BRONIATOWSKI, A.-
22, Rue Tournefort
F-75005 Paris
- BRUGGER, H.- Technische
Universität, Physik
Abteilung E 16,
D-8046 Garching
- BRUNEL, L.C.- SNCI-CNRS, BP 166 X,
F-38042 Grenoble Cedex
- CADERE, D.- Flopetrol
Schlumberger, BP 592,
F-77005 Melun Cedex
- CARVALHO, M.- UNICAMP-IFGW,
Cidade Universitaria,
13100 Campinas, SP, Brasil
- CAVAILLES, J.A.- Laboratoire
Electronique et Physique
Appliquée,
3, Avenue Descartes,
F-94450 Limeil-Brevannes
- CHANG, L.- IBM Thomas J. Watson
Research Center, PO Box 218,
Yorktown Heights, NY 10598,
USA
- CHANG, Y.-C.- University of
Illinois, Department of
Physics, Urbana, IL 61801, USA
- CHELMA, D.S.- AT and T Bell
Laboratories,
Holmdel, NJ 07733, USA
- CLAESSEN, M.- MPI, 25, Avenue des
Martyrs, F-38042 Grenoble
Cedex
- CLEROT, F.- CNET-LAB-ICM,
Route de Tregastel,
F-22301 Lannion Cedex
- COUTURIER, G.- Université
Bordeaux I, LEMME,
351, Cours de la Libération,
F-33405 Bordeaux Cedex
- DAL'BO, F.- CEN de Grenoble,
DRF/SPH/PSC, BP. 85 X,
F-38041 Grenoble Cedex
- DANAN, G.- L2M-CNRS,
196, Avenue Henri Ravera,
F-92220 Bagneux
- DAS SARMA, S.- University of
Maryland, Department of
Physics,
College Park, MD 20742, USA
- DAVIES, R.- GEC Research
Laboratories, Hirst Research
Center, East Lane,
GB-Wembley HA9 7PP, Middlesex
- DELALANDE.- Groupe de Physique des
Solides de l'ENS, 24, Rue
Lhomond, F-75005 Paris
- DESROUSSEAUX, G.- USTL St-Jérôme,
Avenue Esquadrille Normandie-
Niemen,
F-13397 Marseille Cedex 4
- DOHLER, G.M.- Universität
Erlangen, Institut für
Technische Physik,
Erwin Rommelstr. 1,
D-8520 Erlangen
- DUSSEAU, J.M.- USTL,
Place Eugène Bataillon,
F-34060 Montpellier Cedex

- EAVES, L.- University of
Nottingham, Department of
Physics, GB-Nottingham NG7 2RD
- EBERL, K.- Technische Universität,
Physik Abteilung, E-16,
James-Frank Strasse,
D-8046 Garching
- EKENBERG, U.- University of
Oxford, Department of
Theoretical Physics,
1, Klebe Road,
GB-Oxford OX1 3NP
- ELL, C.- Universität Frankfurt,
Institut für Theor. Physik,
Robert-Mayer-Strasse 8,
D-6000 Frankfurt-am-Main 1
- ESAKI, L.- IBM Research Center,
PO Box 218,
Yorktown Heights, NY 10598,
USA
- ETIENNE, B.- L2M-CNRS,
196, Avenue Henri Ravera,
F-92220 Bagneux
- FALCO, C.- University of Arizona
Department of Physics,
Tucson, AZ 85721, USA
- FASOL, G.- Cavendish Laboratory,
Madingley Road,
GB-Cambridge CB3 0HE
- FASOLINO, A.- SISSA,
Strada Costiera, 11,
I-34100 Trieste
- FAURIE.- University of Illinois
at Chicago, Department of
Physics, PO Box 4348,
Chicago, IL 60680, USA
- FENG, S.- Université Paris VII,
Groupe de Physique des Solides
de l'Ecole Normale Supérieure,
2, Place Jussieu,
F-75221 Paris Cedex 05
- FLORES, F.- Universidad Autonoma,
Departamento Fisica Mat.
Condensada, SP-28049 Madrid
- FORCHEL, A.- Universität
Stuttgart, 4. Physikalischs
Institut, Pfaffenwaldring 57,
D-7000 Stuttgart 80
- GAUTHIER, D.- INSA,
Département de Physique,
118, Avenue de Rangueil,
F-31077 Toulouse Cedex
- GERARD, J.-M.- CNET, Laboratoire
de Bagneux, 196, Avenue Henri
Ravera, F-92220 Bagneux
- GERHARDTS, R.- Max-Plank-Institut
für Festkörperforschung
Heisenbergstr 1,
D-7000 Stuttgart 80
- GLASER, E.- Naval Research
Laboratories, Code 6874,
Washington, DC 20375, USA
- GLEMBOCKI, O.- Naval Research
Laboratories, Code 6833,
Washington, DC 20375, USA
- GOLD, A.- Technische Universität
München, Physik Abt. E 16,
D-8046 Garching
- GOLDMAN, V.J.- University of
Princeton, Department
Electrical/Engineering,
Princeton, NJ 08544, USA
- GONTIERS, J.C.- USTL, Groupe
d'Etude des Semiconducteurs,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- GORNICK, E.- Institut für
Experimentalphysik
Technikerstr. 25,
A-6020 Innsbruck
- GRABECKI, G.- APS Varsovie
PL-Warsaw
- GREGORIS, G.- INSA,
Département de Physique,
118, Avenue de Rangueil,
F-31077 Toulouse Cedex
- GRUNTHANER, F.- Jet Propulsion
Laboratory, 4800 Oak Grove
Drive, Pasadena, CA 91109, USA
- GUERET, P.- IBM Zurich Research
Lab., Saumerstr. 4,
CH-8803 Ruschlikon
- HARRIS, J.- Philips Research
Laboratories, Cross Oak Lane,
GB-Redhill RH1 5HA, Surrey

- HATZOPoulos, Z.- Research Center of Crete, GR-Iraklio, Crete
- HAYAMIZU, S.- Fujitsu Laboratories, 10-1 Wakamiya Morionosato, 243-01 Atsugi-Kanagawa, Japan
- HE, J.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- HEINRICH, H.- Universität Linz, Institut für Experimentalphysik, Altenbergerstrasse, A-4020 Linz
- HERMANN, C.- Laboratoire PMC, Ecole Polytechnique, F-91128 Palaiseau Cedex
- HIPOLITO, O.- Caixa Postal 369, 13560 São Carlos, Brasil
- HIROSE, M.- Hiroshima University, Department of Electrical Engin., 724 Higashi-Hiroshima, Japan
- HOGER, R.- Siemens AG, Research and Develop., Otto-Hahn-Ring 6, D-8000 München
- HUANT, S.- CNRS, BP 166 X, F-38042 Grenoble Cedex
- HUGHES, D.- School of Engineering, South Road, GB-Durham DH1 3LE
- HULIN, D.- LOA, Centre de l'Yvette, F-91128 Palaiseau Cedex
- ICHINOSE, H.- University of Tokyo, Inst. Industrial Sc. 7-22-1 Roppongi-Chom, Minato-ku, 106 Tokyo, Japan
- ITSUO, U.- Fujitsu Laboratory, 10-1 Morinisota-Wakamiya, 243-01 Atsugi, Japan
- JACKSON, S.- AT and T Bell Laboratories, Room 1D 3331, Murray Hill, NJ 07974, USA
- JANTSCH, W.- Universität Linz, Institut für Experimentalphysik, A-4040 Linz
- JENSEN, G.U.- Norwegian Institut of Technology, Division of Physical Electronics, N-7034 Trondheim
- JOFFRE, M.- Laboratoire d'Optique Appliquée, ENSTA, Ecole Polytechnique, Batterie de l'Yvette, F-91128 Palaiseau Cedex
- JOHNSON, G.- University of Hull, Physics Department, Cottingham Road, GB-Hull HU6 7RX, North Humberside
- JONCOUR, M.-C.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- JOUANIN, C.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- JUSSERAND, B.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- KALEM, S.- University of Sheffield, Department of Physics, GB-Sheffield S3 7RH
- KAMATA, N.- ATR Research Laboratories, Twin 21 Mid Tower 2-1-61 Shiromi, Higashi-ku, 540 Osaka, Japan
- KANE, M.- Royal Signals and Radar Establishment, GB-Great Malvern WR14 3DX, Worcs.
- KEIL, U.- Universität Erlangen, Institut Technische Physik, Erwin-Rommel-Str 1, D-8520 Erlangen
- KINOSADA, T.- Sharp Corporation, Central Research Lab. 2613-1 Ichinomoto-cho, 632 Tenri-Nara, Japan
- KIRBY, P.- GEC Research Laboratory, Hirst Research Center, East Lane, GB-Wembley HA9 7PP, Middlesex
- KLIPSTEIN, P.- Blackett Laboratory, Imperial College, GB-London SW7 2AZ
- KNAP, W.- Université de Varsovie, PL-Warsaw
- KO, D.- University of Exeter, Department of Physics,

- GB-Exeter EX4 4QL, Devon
- KOBAYASHI, N.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- KOCH, F.- Technische Universität, Physics Abteilung, E 16, Schleissheimerstrasse 17, D-8046 Garching
- KUBISA, M.- APS Varsovie, PL-Warsaw
- LACH, E.- Universität Stuttgart, 4. Physikalisches Institut, Pfaffenwaldring 57, D-7000 Stuttgart 80
- LAMBERT, B.- CNET-LAB-ICM, Route de Tregastel, F-22301 Lannion Cedex
- LARUELLE.- L2M-CNRS, 196, Avenue Henri Ravera, F-92220 Bagneux
- LASCARAY, J.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- LASSABATERE, L.- USTL-LESIC, Place Eugène Bataillon, F-34060 Montpellier Cedex
- LAVIDGE, B.- CEN de Grenoble, DRF/SPH/PSC, BP 85 X, F-38041 Grenoble Cedex
- LE PERSON, H.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- LE SI DANG.- Laboratoire de Spectrometrie Physique, BP 87, F-38402 Saint-Martin-d'Hères Cedex
- LEE, S.W.- Kopin Corporation 695 Myles Standish Blvd, Taunton, MA 02780, USA
- LEVENSON, J.A.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- LEVINE, B.- AT and T Bell Laboratories, Murray Hill, NJ 07097, USA
- LIPPENS, P.- Université de Lille, Centre Hyperfréquence et Semi-
- Conducteurs, F-59655 Villeneuve-d'Ascq Cedex,
- LITWIN-STASZ, E.- CHP, Unipress, Pologne
- LOMMER, G.- König-Phillip Weg 9, D-8400 Regensburg
- MAAN, J.- Max-Plank-Institut, Institut für Festkörperforschung, BP 166 X, F-38042 Grenoble Cedex
- MADHUKAR.- University of Southern California, Dept Materials Science, Univerty Park, Los Angeles, CA 90089-0241, USA
- MAGNEA, N.- CEN de Grenoble, DRF/SPH, BP 85 X, F-38041 Grenoble Cedex
- MALCHER, F.- Schwabenstr. 9 D-8400 Regensburg
- MARCLAY, E.- IBM Forschungslabor, Sauemerstrasse 4, CH-8803 Rueschlikon
- MARTIN, G.- LEP, 3, Avenue Descartes, F-94450 Limeil-Brévannes
- MARTINEZ, G.- SNCI, 25, Avenue des Martyrs, F-38042 Grenoble Cedex
- MARZIN, J.-Y.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- MASSIES, J.- LPSES-CNRS, Rue Bernard Gregory, Sophia Antipolis, F-06560 Valbonne
- MATHIEU, H.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- MELMAN, P.- GTE Laboratories Inc., 40 Sylvan Road, Waltham, MA 02154, USA
- MENDEZ.- IBM Watson River Center, PO Box 218, Yorktown Heights, NY 10598, USA
- MENON, M.- Texas A and M

- University,
Department of Physics,
College Station, TX 77843,
USA
- MERLE D'AUBIGNE, Y.- Laboratoire
de Spectrométrie Physique,
BP 87,
F-38402 Saint-Martin-d'Hères
Cedex
- MERLIN, R.- University of
Michigan, Department of
Physics, Ann Arbor, MI 48109,
USA
- MESEGUER, F.- Universidad
Autónoma, Instituto de
Ciencia de Materiales
SP-28049 Madrid
- MEYNADIER, M.H.- Bell
Communications Research,
Red Bank, NJ 07701, USA
- MIYAZAKI, T.- University of
Tsukuba, Institute of
Material Science,
305 Sakura-Ibaraki, Japan
- MOLENKAMP, L.W.- Philips Research
Laboratory, PO Box 80000,
NL-5600 JA Eindhoven
- MOLINARI, E.- CNR, Istituto
Corbino, Via Cassia 1216,
I-00189 Roma
- MOLLOT, F.- L2M-CNRS, 196, Avenue
Henri Ravera, F-92220 Bagneux
- MOORE, K.J.- Philips Research
Laboratories, Cross Oak Lane,
GB-Redhill RH1 5HA, Surrey
- MORONI, D.- LEP,
3, Avenue Descartes,
F-94450 Limeil-Brévannes
- MOSSER, V.- SMR-Schlumberger,
Physique des Capteurs,
BP 121, F-92124 Montrouge
Cedex
- MULOT J.Y.- CSTL, Groupe d'Etude
des Semiconducteurs,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- MUNEKATA, H.- IBM Thomas J. Watson
Research Center, P.O. Box 218,
Yorktown Heights, NY 10598,
USA
- MUTO, S.- Fujitsu Laboratories Ltd,
10-1 Morinosato Wakamiya,
243 Atsugi-Kanagawa-ken,
Japan
- NAGLE, J.- Max-Plank-Institut,
Institut für Festkörper-
forschung, Heisenbergstr. 1,
D-7000 Stuttgart
- NAHORY, R.E.- Bell Communications
Research, 331, Newman Springs
Road, Red Bank, NJ 07701, USA
- NEILSON, D.- School of Physics,
University of New South Wales,
Kensington, NSW 2033,
Australia
- NERI, C.- 103, Avenue Henri
Dunant, Bât. 10, Apt. 844,
F-06100 Nice
- NICKEL, H.- FTZ,
Am Kavalleriesand 3,
PO Box 5000, D-6100 Darmstadt
- NURMIKKO, A.- Brown University
Division of Engineering,
Providence, RI 02912, USA
- O'REILLY, E.P.- University of
Surrey, Department of
Physics, GB-Guildford GU2 5XH,
Surrey
- OKAZAKI, M.- University of Tsukuba,
Institute of Materials
Science, 305 Sakura-Ibaraki,
Japan
- OKUMURA, H.- Electrotechnical Lab.
1-1-4, Umezono Sakura-mura,
Niihari-gun, 305 Ibaraki,
Japan
- ONABE, K.- NEC Corporation,
1-1 Miyazaki, 4-chome,
Miyamae-ku, 213 Kawasaki-
Kanagawa, Japan
- OPPOLZER, H.- Siemens, ZT ZFE FKET
41, Postfach 830952,
D-8000 München 83
- ORGONASI, J.- Groupe de Physique
de l'ENS, 24, Rue Lhomond,
F-75005 Paris
- OUDAR, J.-L.- CNET, Laboratoire de
Bagnoux, 196, Avenue Henri
Ravera, F-92220 Bagnoux

- PALMIER, J.-F.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- PARIS, E.- L2M-CNRS, 196, Avenue Henri Ravera, F-92220 Bagneux
- PATILLON, J.-N.- LEP, 3, Avenue Descartes, F-94450 Limeil-Brévannes
- PAUTRAT, J.-L.- CEN de Grenoble, DRF/PSC, BP 85 X, F-38041 Grenoble Cedex
- PERRY, C.- Northeastern University, Physics Department, Boston, MA 02115, USA
- PETER, G.- Philipps Universität, FB-Physik Renthof 5, D-3550 Marburg
- PLANEL, R.- L2M-CNRS, 196, Avenue Henri Ravera, F-92220 Bagneux
- PLATERO, G.- Universidad Autonoma, Departamento Física del Estado Salida, Cantoblanco, SP-28049 Madrid
- PLOOG, K.- Max-Plank-Institut, Institut für Festkörperforschung, Heisenbergstrasse 1, D-7000 Stuttgart 80
- PORTAL, J.-C.- CNRS-INSA-SNCI, 118, Avenue de Rangueil, F-31077 Toulouse Cedex
- POUDOULEC, A.- CNET, Route de Trégastel, F-22301 Lannion Cedex
- PRIESTER, C.- ISEN, 41, Bd Vauban, F-59046 Lille Cedex
- PULSFORD, N.- University of Oxford, Dept. Physics, Clarendon Laboratory, GB-Oxford OX1 3PU
- RAISIN.- USTL, Place Eugène Bataillon F-34060 Montpellier Cedex
- RAJ, R.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- RAO, E.- CNET, Laboratoire de Bagneux 196, Avenue Henri Ravera, F-92220 Bagneux
- RAVANOMANTATO, S.- USTL, Groupe d'Etudes des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- RAYMOND, A.- USTL, Place Eugène Bataillon, F-34060 Montpellier Cedex
- RAZEGHI, M.- Thomson-CSF, LCR, Domaine de Corbeville, BP 10, F-91401 Orsay Cedex
- REGRENY, A.- CNET-LAB-ICM, Route de Trégastel, F-22301 Lannion Cedex
- RENN, M.- Universität Erlangen-Nürnberg, Institut für Technische Physik, Erwin-Rommel-Str 1, D-8520 Erlangen
- ROBERT, J.L.- USTL, Place Eugène Bataillon, F-34060 Montpellier Cedex
- ROMESTAIN, R.- CNRS, Laboratoire de Spectrométrie Physique, BP 87, F-38402 Saint-Martin-d'Hères Cedex
- ROTGER, T.- CNRS, Max-Plank-Institut, Institut für Festkörperforschung, BP 166 X, F-38042 Grenoble Cedex
- ROTH, A.- National Research Council, Division of Physics, 100 Sussex Drive, Ottawa K1A 0R6, Ontario Canada
- ROUZEYRE, M.- USTL, Groupe d'Etude des Semiconducteurs, Place Eugène Bataillon, F-34060 Montpellier Cedex
- RYAN, T.- Philips I and E, Lelyweg 1, NL-7602 EA Almelo
- SAKAKI, H.- Institute of Industrial Science, University of Tokyo, 22-1-Roppongi 7 Chome, Minato-ku, Tokyo 106, Japan

- SAKAMOTO, T.- Electrotechnical Lab., 1-1-4 Umezono
Sakura-mura, Niihari-gun,
305 Ibaraki, Japan
- SAMINADAYAR, K.- CEN de Grenoble,
PO Box 85 X,
F-38041 Grenoble Cedex
- SAPIREL, J.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- SCHNEIDER, H.- Max-Plank-Institut, Institut für Festkörperforschung, Heisenbergstrasse 1, D-7000 Stuttgart 80
- SERMAGE, B.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- SHAM, L.- University of California, Department of Physics, B-019, La Jolla, CA 92093, USA
- SHORTHOSE.- University of Oxford, Clarendon Laboratory, GB-Oxford OX1 3PU
- SIBILLE, A.- CNET, Laboratoire de Bagneux, 196, Avenue Henri Ravera, F-92220 Bagneux
- SICART, J.- USTL, Place Eugène Bataillon, F-34060 Montpellier Cedex
- SINGLETON, J.- The Clarendon Laboratory, Parks Road, GB-Oxford OX1 3PU
- SOTOMAYOR TORRES, C.M.- University of St-Andrews, Physics Department North Haugh GB-St-Andrews KY16 9SS
- STARCK, C.- Laboratoire de Marcoussis, CR-CGE, Route de Nozay, F-91460 Marcoussis
- STAUFFER, L.- Laboratoire de Physique des Solides, FST, 4, Rue des Frères Lumière, F-68093 Mulhouse Cedex
- STEBE, B.- CLOES-SUPELEC, 2, Rue Edouard Belin, F-57078 Metz Cedex
- STIEVENARD, D.- CNRS-ISEN,
- 41, Bd Vauban,
F-59046 Lille Cedex
- STOBBS,..- University of Cambridge, Department of Materials Science, Pembroke Street, GB-Cambridge CB2 2QZ
- SUAUDEAU, E.- DGA/DRET VST 1, 26, Bd Victor, F-75996 Paris Armées
- SUMMERS, C.- Physical Science Division, Georgia Technical Research Institute, Atlanta, GA 30332, USA
- TAPFER, L.- Max-Plank-Institut, Institut für Festkörperforschung, Heisenbergstr. 1, D-7000 Stuttgart 80
- TARUCHA, S.- Max-Plank-Institut, Institut für Festkörperforschung, Heisenbergstr. 1, D-7000 Stuttgart 80
- TEJEDOR, C.- Universidad Autonoma, Departamento Fisica Materia Condensada, Cantoblanco, SP-28049 Madrid
- TEMPEL, G.- Technische Universität, Physik Abteilung, E 16, James-Franck-Str., D-8046 Garching
- TESTE DE SAGEY.- Equipe CNRS, E.R. 060 210 1, Place Aristide Briand, F-92195 Meudon Cedex
- TEWS, H.- Siemens, ZT-ZTE-FKEZ 41, Otto-Hahn-Ring 6, D-8000 München 83
- THUILLER, J.C.- Université de Dijon, Faculté des Sciences, BP 138, F-21004 Dijon Cedex
- TRANKLE, G.- Universität Stuttgart, 4. Physikalisches Institut Pfaffenwaldring 57, D-7000 Stuttgart 80
- TSANG, W.-T.- AT and T BELL Laboratories, Holmdel, NJ 07733, USA
- TUFFIGO, H.- CEN de Grenoble, DRF/SPH/PSC, BP 85 X, F-38041 Grenoble Cedex

- TURCO, F.- CNRS-LPSES,
Rue Bernard Gregory, Sophia
Antipolis, F-06560 Valbonne
- TWARDOWSKI, A.- University of
Warsaw, Institute of
Experimental Physics,
PL-H0Z A69 Warsaw
- UDDIN, A.- Department of Physics
CTH, S-412 96 Göteborg
- USUI, A.- NEC Corporation,
1-1 Miyazaki 4-Chome,
Miyamae-ku,
213 Kawasaki-Kanagawa, Japan
- VANBESIEN, O.- Université Lille I,
Centre Hyperfréquence et
Semicongducteurs,
F-59655 Villeneuve-d'Ascq
Cedex
- VETTESE, F.- USTL,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- VIEREN, J.-P.- Groupe de Physique
des Solides de l'ENS,
24, Rue Lhomond, F-75005 Paris
- VIÑA, L.- Universidad Zaragoza,
Fac. Ciencias-CSIC,
SP-50009 Zaragoza
- VINTER, B.- Thomson-CSF, LCR,
BP 10, Domaine de Corbeville,
F-91401 Orsay Cedex
- VODJDANI, N.- Thomson-CSF,
BP 10, Domaine de Corbeville,
F-91401 Orsay Cedex
- VOILLOT, F.- INSA, Laboratoire de
Physique des Solides,
- 118, Avenue de Rangueil,
F-31077 Toulouse Cedex
- VOISIN, P.- Groupe de Physique des
Solides de l'ENS,
24, Rue Lhomond, F-75005 Paris
- VOOS, M.- Groupe de Physique des
Solides de l'ENS,
24, Rue Lhomond, F-75005 Paris
- WALSH, D.- McGill University,
3600 University St.
Montreal H3A 2T8, Québec,
Canada
- WISNIEWSKI, P.- CHP, Unipress
Pologne
- WORONICK, S.- 5, New York Avenue,
Stony Brook, NY 11790, USA
- YABLONOVITCH, E.- Bell
Communications Research,
Red Bank, NJ 07701, USA
- ZACHAI, R.- Technische
Universität, Physik
Abteilung, E 16, James-Franck-
Str., D-8046 Garching
- ZAWADZKI, M.- USTL, Groupe
d'Etudes des Semicongducteurs,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- ZEKEDES, K.- USTL, Groupe d'Etude
des Semicongducteurs,
Place Eugène Bataillon,
F-34060 Montpellier Cedex
- XU, Zhong-Ying.- Institut of
Semicongductors, PO Box 912,
Beijing,
Popular Republic of China

CONTENTS

L. ESAKI.- The evolution of quantum structures.....	C5-1
W.T. TSANG.- Chemical beam epitaxy of III-V semiconductor heterostructures (Invited Paper).....	C5-13
A. USUI and H. WATANABE.- Atomic layer epitaxy : a new tool for novel modulated semiconductor structures (Invited Paper).....	C5-21
A. KOBAYASHI and S. DAS SARMA.- Monte-Carlo simulation of epitaxial growth : $Ge_x Si_{(1-x)}$ /Si interfaces.....	C5-29
W.M. STOBBS.- T.E.M. techniques for the atomic level characterisation of nanometre scale multilayers (Invited Paper)	C5-33
I. UMEBU, S. KOMIYA, T. NAKAMURA, S.-I. MUTOH and A. IIDAI.- Multiple characterization of structural perfection in GaAs/AlAs superlattice.....	C5-41
H. OKUMURA, I. YOSHIDA, E. MUNHEYAMA, S. MISAWA, K. ENDO and S. YOSHIDA.- Photoemission study of alloys and heterostructures of III-V compound semiconductors.....	C5-45
S.C. WORONICK, B.X. YANG, A. KROL, Y.H. KAO, H. MUNEKATA, L.L. CHANG and J.C. PHILLIPS.- X-ray reflectivity of InAs/GaAs heterostructures with surface and interfacial roughness.....	C5-51
C.M. FALCO.- Fabrication and future of metallic superlattices (Invited Paper).....	C5-57
H. OPPOLZER.- Transmission electron microscopy of multilayered metal and semiconductor structures (Invited Paper).....	C5-65
F.J. GRUNTHANER, J.K. LIU and B. HANCOCK.- The role of strain and surface stoichiometry in the synthesis of InAs/GaAs (100) multilayer compounds.....	C5-75
C. RAISIN, H. TEGMOUSSE and L. LASSABATERE.- Formation and properties of MBE grown AlSb-GaSb (100) interfaces.....	C5-77
R.M. BIEFELD.- The use of compositionally graded layers to minimize surface defects in In(AsSb) strained-layer superlattices.....	C5-81
S. TARUCHA and K. PLOOG.- Electric field effects on excitons in $Al_x Ga_{1-x} As$ quantum wells and their applications to optoelectronic devices (Invited Paper).....	C5-85
D. BIMBERG, R.K. BAUER, D. OERTEL, D. MARS and J.N. MILLER.- Noncommutative structure of GaAs quantum well interfaces and inequivalent interface impurity incorporation.....	C5-93

- J.Y. LAVAL, C. DELAMARRE, A. DUBON, G. SCHIFFMACHER, G. TESTE de SAGEY, B. GUENAIS and A. REGRENY.- Atomic structure of interfaces in GaAs/Ga_{1-x}Al_xAs superlattices. C5-97
- M. TANAKA, H. ICHINOSE, T. FURUTA, Y. ISHIDA and H. SAKAKI.- Direct observation of atomic step structure at GaAs-AlAs heterointerfaces in transmission electron microscopy and improved lattice image to detect the interface by material-dependent patterns..... C5-101
- P. AUVRAY, M. BAUDET, A. REGRENY, A. POUDOULEC and B. GUENAIS.- An X-ray diffraction study of disorder in GaAlAs-GaAs superlattices..... C5-105
- T.W. RYAN, C. LUCAS, P.D. HATTON and S. BATES.- Characterisation of nanometer-scale epitaxial structures by grazing-incidence x-ray scattering..... C5-109
- E.V.K. RAO, F. BRILLOUET, P. OSSART, Y. GAO, J. SAPRIEL and P. KRAUZ.- Respective roles of impurities and defects in Al/Ga interdiffusion in ion implanted GaAs-Al_xGa_{1-x}As superlattices..... C5-113
- K. ONABE, Y. IDE and M. SUGIMOTO.- Piezoreflectance characterization of GaAs/AlAs multiple quantum wells..... C5-117
- P.D. LAO, W.C. TANG, A. MADHUKAR and F. VOILLOT.- Resonant mixing between electronic and optical vibrational states of a quantum well structure..... C5-121
- L.W. MOLENKAMP, G.W. 't HOOFT, W.A.J.A. van der POEL and C.T. FOXON.- Interface related emission from an MBE-grown (Al,Ga)As heterostructure..... C5-127
- W.K. GE, Z.Y. XU, Y. YAN, J.Z. ZU, Z.B. ZHENG and D.Z. SUN.- The temperature characteristics of the photoluminescence from GaAs-GaAlAs multiple quantum well structures..... C5-131
- B. SERMAGE, M.F. PEREIRA Jr, F. ALEXANDRE, J. BEERENS, R. AZOULAY, C. TALLOT, A.M. JEAN-LOUIS and D. MEICHENIN.- Interface recombination in GaAs-GaAlAs quantum wells..... C5-135
- M. ERMAN, C. ALIBERT, J.A. CAVAILLES, P. FRIJLINK and C. BOUCHE.- Assessment of a multiple quantum well and a superlattice structure by spectroscopic ellipsometry, electoreflectance and photoreflectance modulation spectroscopy..... C5-139
- D. MORONI, J.N. PATILLON, E.P. MENU, P. GENTRIC and J.P. ANDRÉ.- Optical investigation of InGaAs-InP quantum wells..... C5-143
- J. SINGLETON, N.J. PULSFORD, D.J. MOWBRAY, M.S. SKOLNICK, L.L. TAYLOR, S.J. BASS, R.J. NICHOLAS and W. HAYES.- Magnetooptics of (Ga,In)As quantum wells : exciton binding energies and carrier effective masses..... C5-147
- H. MUNEKATA, T.P. SMITH III, F.F. FANG, L. ESAKI and L.L. CHANG.- Electrons and holes in InAs-Ga(Al)Sb(As) quantum wells..... C5-151

- C. RAISIN, L. LASSABATERE, P. VOISIN, C. ALIBERT and C. ANCE.- GaSb-AlSb quantum wells, elaboration and optical properties..... C5-155
- A. FORCHEL, U. CEBULLA, G. TRÄNKLE, W. OSSAU, G. GRIFFITHS, S. SUBBANNA and H. KROEMER.- Temperature and magnetic field induced bandstructure reversal in GaSb/AlSb quantum wells C5-159
- T.G. ANDERSSON, V. KULAKOVSKI, Z.-G. CHEN, A. UDDIN, J. VALLIN and J. WESTIN.- Optical study on band edge offset in strained MBE grown (InGa)As-GaAs and (InGa)As-(AlGa)As quantum wells..... C5-163
- J.M. GERARD, J.Y. MARZIN and J. PRIMOT.- Growth, characterization and optical studies of $In_xGa_{1-x}As / In_yAl_{1-y}As$ strained-layer superlattices on InP..... C5-169
- C. STARCK, L. GOLDSTEIN, M. BOLOU, D. BONNEVIE, M. LAMBERT and C. AUDRY.- Growth and characterization of $Ga_xIn_{1-x}As_yP_{1-y}/InP$ quantum wells..... C5-175
- K. BAJEMA, R. MERLIN, F.-Y. JUANG, S.-C. HONG, J. SINGH and P.K. BHATTACHARYA.- Stark effect in quantum wells : Raman scattering by intersubband transitions..... C5-179
- J. BLEUSE, P. VOISIN, M. VOOS, L.L. CHANG and L. ESAKI.- Experimental investigations of the quantum photovoltaic effect in InAs-GaSb semiconductor superlattices..... C5-183
- M.-H. MEYNADIER, N. TABATABAIE, R.E. NAHORY and J.P. HARBISON.- Very large photovoltaic effects in modulation-doped heterostructures..... C5-187
- S. KALEM.- Optical studies in a-Si:H/a-SiN_x:H superlattices... C5-191
- F. VETTESE, J. SICART, J.L. ROBERT, G. VINCENT and A. VAREILLE.- Electronic properties of Si-inversion layer with modulated band structure induced by periodic electron beam irradiation of gate oxide..... C5-195
- T. MIYAZAKI, K. AIZAWA, H. AOKI, C. ITOH and M. OKAZAKI.- Monte-Carlo study of epitaxial overlayer with substantial lattice mismatch..... C5-199
- C. PRIESTER, G. ALLAN and M. LANNOO.- Ultra-thin semiconductor quantum wells : potential shapes and strain effects..... C5-203
- U. EKENBERG.- Quantum well enhancement of nonparabolicity effects on the effective electron mass..... C5-207
- A. TWARDOWSKI and C. HERMANN.- Calculation of the circular polarization of quantum well photoluminescence..... C5-211
- G.E.W. BAUER and T. ANDO.- Theory of quantum well excitons in electric and magnetic fields..... C5-215
- F. GERBIER and G. BASTARD.- Binding energies and capture of electrons, holes and excitons on quantum well interface defects..... C5-219
- M.H. DEGANI and O. HIPOLITO.- Exciton-phonon system in GaAs-Ga_{1-x}Al_xAs quantum-well wires..... C5-223