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Progress in Nano-Electro-Optics VI

Nano-Optical Probing, Manipulation, Analysis, and Their Theoretical Bases

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Preface to *Progress in Nano Electro-Optics*

Recent advances in electro-optical systems require dramatic increases in the degree of integration between photonic and electronic devices for large-capacity, ultrahigh-speed signal transmission and information processing. To meet this demand—which will become increasingly strict in the future—device size has to be scaled down to nanometric dimensions. In the case of photonic devices, this requirement cannot be met only by decreasing the material sizes. It is necessary to decrease the size of the electromagnetic field used as a carrier for signal transmission. Such a decrease in the electromagnetic field's size, beyond the diffraction limit of the propagating field, can be realized in optical near fields.

Near-field optics has progressed rapidly in elucidating the science and technology of such fields. Exploiting an essential feature of optical near fields, i.e., the resonant interaction between electromagnetic fields and matter in nanometric regions, important applications and new directions have been realized and significant progress has been reported. These advances have come from studies of spatially resolved spectroscopy, nanofabrication, nanophotonic devices, ultrahigh-density optical memory and atom manipulation. Since nanotechnology for fabricating nanometric materials has progressed simultaneously, combining the products of these studies can open new fields to meet the requirements of future technologies.

This unique monograph series, entitled *Progress in Nano Electro-Optics*, is being introduced to review the results of advanced studies in the field of electro-optics at nanometric scales. The series covers the most recent topics of theoretical and experimental interest on relevant fields of study (e.g., classical and quantum optics, organic and inorganic material science and technology, surface science, spectroscopy, atom manipulation, photonics and electronics). Each chapter is written by leading scientists in the relevant field. Thus, high-quality scientific and technical information is provided to scientists, engineers and students who are and who will be engaged in nano electro-optics and nanophotonics research.

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Yokohama *Motoichi Ohtsu*
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