Nano Science and Technology: Novel Structures and Phenomena

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Preface

This volume represents the proceedings of the second Croucher ASI on Nano Science and Technology held at HKUST. The first one was exactly three years ago.

This ASI invited six plenary speakers. They not only delineated the cutting edge of research in nano science and technology, but in the process also "wowed" the audience and created a stir. Prof. Donald Eigler and Prof. Kunio Takayanagi were especially impressive in showing pictures and videos of atomic manipulations, creating novel functionalities at the nanometer scale. Their talks opened listeners' eyes to the future potential of nanotechnology, and brought quantum mechanics, formerly a somewhat abstract topic, to a direct visual level. Prof. Steve Louie showed that the greatly increased predictive power of theory and simulation has brought us a step closer to the holy grail of "material-by-design," whereby the material properties can be predicted and their associated structures specified as recipes for fabrication. Prof. Paul Chaiken and Prof. Pierre Petroff showed two orthogonal approaches to the fabrication of semiconductor quantum dots (artificial atoms), and their potentials to optical and electronic technologies. Prof. Herbert Gleiter, a pioneer in nanoscience and nanotechnology, delineated the direction of nanotechnology in traditional disciplines such as metallurgy.

Complementing the plenary talks were the excellent invited talks by both local, Chinese mainland, and Taiwan speakers. The talks gave a snapshot of the best works done in this region over the past two years, and showed the great progress that has been achieved recently in nanoscience and nanotechnology in this region.

From the responses of the participants, it is clear that the topic of nanoscience and nanotechnology has captured a resonance of our times. During the discussion sessions of the ASI, there were lively debates on the nature of this "nano phenomenon" and where it is leading us. From our personal observations at the level of working scientists, it is clear that the primary driving force for the nano phenomenon comes from the scientific possibilities that arise due to the confluence of advances in characterization, measurements, and computation. Research fundings are the consequence, rather than the cause, of this manifest "destiny." Hence the nano phenomenon represents a historical trend, starting from thousands of years ago with the human mastery of kilometre-scale technology (e.g., Egyptian

Pyramids, the Chinese Great Wall), to the millimetre-scale technology (e.g., watches) a few hundred years ago, to the micrometre-scale technology (e.g., microelectronics) of the twentieth century, to the present development of the nanometre-scale technology platform. Once the nanotechnology platform is established, perhaps ten to twenty years from now, there is no doubt that another revolution in human lives would occur.

It is our hope that the present volume can capture the spirit of this Croucher ASI and give readers one cross sectional view of the rapidly evolving nano science and technology.

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