for one surface orientation of silicon. The growth of semiconductor systems by molecular beam epitaxy (MBE) will be included in the Symposium programme. MBE has caused much excitement since it allows an excellent opportunity for *in situ* crystal growth characterisation, and the fabrication of novel semiconductor structure, of great potential interest to the theoretical and experimental physicist.

The organisation of the Phase Transitions Symposium at York allows a good opportunity to bring together experts from that field with surface scientists, in joint session, to discuss the emerging area of surface magnetism and phase transitions. Although the reconstruction of semiconductor surfaces is well established, the occurrence of similar phenomena in the case of metals has long been the subject of controversy. Recent evidence for metal surface reconstruction and the occurrence of two dimensional order-disorder and phase transition-like phenomena in absorbate layers will be presented and theoretical models of these systems will be discussed during the Surface Physics Symposium.

C. J. Todd

Symposium A: Modern Optics

The Modern Optics Symposium will combine some of the features of a review meeting with those of a specialist conference. There will be five sessions comprising solicited papers as detailed below, and three poster sessions for contributed papers.

Echoing the overall theme of the Conference, the solicited papers have been selected with special attention to areas of expected scientific growth, and will provide an authoritative review of current trends. The Symposium has been structured to ensure an orderly coverage of the field of modern optics, and to attract a wide international audience.

The Poster Sessions will provide a forum for original contributions, and to aid topicality the submission deadline for extended abstracts has been set reasonably close to the date of the Conference.

The main topics of the Modern Optics Symposium will be :

(1) Newer non-linear effects in atoms, molecules and solids and their interpretation, including multiphoton transitions, super-radiance and the efficient generation of optical harmonics.

(2) Latest advances in lasers and laser techniques, especially relating to very short wavelengths with the possibility of high-resolution spectroscopy of tightly-bound electrons ; to very high powers leading to a possible approach to harnessing nuclear fusion to generate energy if the formidable technical problems can be overcome ; and to ultra short pulses which can be applied to investigate relaxation processes in macromolecules.

(3) Latest advances in optical electronics, especially in terms of the physics and materials involved, applied to optical communication, electronics functions at optical frequencies, data and image processing and storage, and holography.

(4) The wide range of spectroscopic investigation and application which has been opened up by the unique and developing properties of tunable lasers from UV to submillimetre wavelengths.

L. A. Thomas

Symposium B 2: Phase Transitions

The last decade has seen an extensive development of the state of knowledge of critical behaviour at second-order phase transitions, both theoretically and experimentally. On the theoretical side, ideas from statistical mechanics and from field theory have merged into renormalization group theory, which provides an understanding of universality and scaling behaviour, deviating from Landau theory below a marginal dimensionality.

Remarkable progress has recently been made in the calculation of critical properties by studying the asymptotic behaviour of high-order perturbations in renormalized field theory. Other new developments concern the coexistence of domains, soliton-like behaviour of domain walls, and the topology of defects in the order parameter field. It is in this context of order parameter fields and their singularities that intimate contact is made with elementary-particle physics, and it is hoped that this will lead to fruitful cross-fertilization. An invited lecture on Phase Transitions and Quark Confinement will illustrate some aspects of this relation.

The theory of spatially varying order parameter fields has found an interesting application in the study of structures incommensurate with the crystal lattice, and their transitions to commensurate structures. Some problems connected with such incommensurate phases will be reviewed in an invited lecture.

The dynamical behaviour in the critical region of a phase transition is of particular interest, both because of the phenomenon of critical slowing-down of the order-parameter fluctuations, and of their interaction with hydrodynamic modes resulting from conservation laws. Most theoretical studies assume phenomenological equations of motion for the order-parameter field, but attempts have already been made to start from the microscopic motion of the system. Experimentally, a large supply of information is available from inelastic scattering of neutrons and of light, from ultrasonic experiments, and from various resonance methods. Still unresolved is the question of the existence of an intrinsic central peak of the dynamic structure factor. An invited lecture will review some aspects of recent developments in critical dynamics.

Important problems arise in connexion with defects and with disordered systems. For all experimental methods using impurity atoms as probes to measure the local critical behaviour of the host crystal, it is essential to know how this behaviour is changed by the impurity. The possibility of a condensation of a local order parameter at the impurity above the phase transition of the host, and the nature of such a locally condensed state is another interesting problem. Furthermore, impurities will contribute to the bulk critical behaviour, and may be responsible for a central peak of the dynamic structure factor.

Disordered systems pose a number of interesting questions, such as: Will the transition remain sharp? How will the critical behaviour change for various types of disorder? Can disorder give rise to new phase transitions? One such transition which has been predicted to occur for certain types and amounts of disorder is the transition to a "spin-glass phase" with uncommon type of ordering. An invited lecture will review the situation in the spin-glass problem.

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The surface of a crystal, apart from acting as a defect for phase transitions of the bulk, is also the site for interesting two - dimensional phase - transition - like phenomena including order-disorder transitions (melting) of adsorbate films, surface segregation and related ordering effects, reconstruction of semiconductor surfaces, surface magnetism, etc. Two combined sessions of the Phase Transitions Symposium and the Surface Physics Symposium, with a number of invited talks, will be devoted to this important topic.

New and exciting developments are taking place in the area of phase-transition-like phenomena in systems far from thermo-dynamic equilibrium. Lasers, hydrodynamic flows, current flows in semiconductors, chemical reactions, all exhibit instabilities with bifurcation into new phases of broken symmetry. Breaking of time translation symmetry leads to dynamical structures such as oscillatory states or solitary travelling-wave states. A highly important discovery is the possibility of bifurcation into strongly non-periodic states with pseudo-ergodic properties, which is expected to lead to an improved understanding of turbulence. Some aspects of this area will be reviewed in two invited lectures on hydrodynamic instabilities.

H. Thomas

Symposium C 2: Hot Plasma in Space and Laboratory

The physics of hot plasma has been growing at an appreciable rate during the last decades, due to the challenge of both its possible application in energy generation through thermonuclear fusion and the role it plays in space and astrophysics. It is a consequence of this growth that specialization has become considerable. Even for a plasma physicist it becomes increasingly difficult to keep up with the rapid development in the different fields, and there are not many opportunities to overcome the barriers of specialization, The Symposium on Hot Plasma in Space and Laboratory has been conceived to offer just such an opportunity. It is intended to give an overview, accessible also to non-specialists, over a number of selected topics in which relevant progress has been made during the past years. At the same time, an attempt will be made to characterize and display the place plasma physics has in the frame of physics as a whole: plasma physics is concerned with the description of the behaviour of a large number of charged particles interacting with each other. The great richness in phenomena appearing in plasmas and at the same time the difficulties and the appeal of the discipline are directly due to this fact.

Taking this viewpoint, it is evident that putting the accent of the Symposium on collective phenomena in hot plasmas is rather a way of presentation than a selection criterion. As far as laboratory plasmas are concerned, some aspects of three very different types of plasma of thermonuclear interest will be examined, namely: magnetically confined toroidal plasmas; plasmas generated by intense laser light beams impinging on matter; plasmas produced in a magnetic field by relativistic electron beams. These three topics offer an opportunity to show how important collective effects are, both in plasma formation and heating, and in imposing limitations on the existence of certain plasma states, due to the appearance of gross instabilities or to transport induced by turbulence. In many cases heating and transport phenomena can, in fact, be visualized as a consequence of plasma particles interacting with wave fields which are self-consistently generated in the plasma. Effects of this same kind are also responsible for most of the energy transfer phenomena appearing in astrophysical plasmas, and some examples of this kind will be discussed at the Symposium too. On the order hand, it is gross instability and again turbulence-induced transport effects determining essential limitations on plasma confinement, which impose important constraints on the way to utilizing plasmas in energy production by fusion of light nuclei.

Somewhat apart from these questions, examples of recent important developments in plasma diagnostics will be presented at the Symposium. Here again, the leitmotiv of the Symposium becomes apparent as plasma diagnostics is largely concerned with making evident, collective phenomena.

F. Engelmann

Symposium C 1:

For the purpose of this short introduction to the C1 Symposium, Nuclear Astrophysics may be defined as that peculiar marriage of physics and astronomy which seeks to explain how, why, when, where and in what quantity the elements and their isotopes were produced and are being produced today. These may seem to be extraordinarily ambitious questions for such a young science to answer and, in all their details, they are. However, today we do have a firm basis of observational evidence supplied by the solar system, cosmic rays, gas clouds, stars and distant galaxies; experimental data obtained from laboratories across the world concerning reaction cross sections and the like; and the theoretical knowledge (sometimes) to put it all together in a coherent form so that we do have some confidence in the general picture that is emerging and which we hope to see coloured-in more during our symposium.

Some of the most profound statements modern science makes about the Universe are embodied in the words "Hot Big Bang". The success of the simplest cosmological model of the Hot Big Bang, based on the observed highly isotropic 2.9K microwave background radiation and the density of visible matter in the Universe, in accounting for the observed overall level of the hydrogen and helium abundance and of their isotopes, is remarkable and is widely

Symposium D:

The investigation of interactions between heavy particles i.e. atoms and complex nuclei is an exciting field of physics that has been steadily growing during the past few years. A wide range of new physical phenomena and submicroscopic behaviour has been discovered. It is the goal of this Symposium to present in a selection of review talks first results on nuclear, atomic and solid state physics.

Many projects have burgeoned in European laboratories that operate tandem Van de Graaff accelerators, the first accelerators for heavy ions. One of the leading heavy ion laboratories has been established at the Joint Institute for Nuclear Research at Dubna, from where a large number of