in sunspots summarizes the latest observational results and theoretical interpretations of the fine structure in sunspots.

Until the late 1990s, the rich Hyades and the sparse UMa clusters were the only coeval, comoving concentrations of stars known within ~60 pc of the earth. Both are hundreds of millions of years old. Then beginning in the late 1990s, the TW Hydrae Association, the Tucana/Horologium Association, the beta Pictoris Moving Group, and the AB Doradus Moving Group were identified within ~60 pc of the earth, and the eta Chamaeleontis cluster was found at 97 pc. These young groups (ages 8–50 m.y.), along with other nearby young stars, will enable imaging and spectroscopic studies of the origin and early evolution of the planetary system. The article on Young stars near the sun tells the story.

Dynamical astronomy: Turbulence affects the structure and motions of nearly all temperature and density regimes in the interstellar gas. Interstellar turbulence has implications for the dispersal and mixing of the elements, cloud chemistry, cosmic-ray scattering, and radio-wave propagation through the ionized medium. The two-part review on Interstellar turbulence summarizes the observations, theory, and simulations of interstellar turbulence and its applications in many fields of astrophysics. The first part discusses the dense cool phases of interstellar matter, energy sources, turbulence theory and simulations. The second part considers the effects of turbulence on element mixing, chemistry, cosmic-ray scattering and radio scintillation.

Planets form in the circumstellar disks of young stars. The article on Planet formation by coagulation: a focus on Uranus and Neptune reviews the basic physical processes by which the solid bodies accrete each other and alter each others' random velocities, and provide order-of-magnitude derivations for the rates of these processes. The first half of the review deals with the basic physical processes responsible for the evolution of the masses and velocity dispersions of bodies in a protoplanetary disk. The second half is concerned with the growth of planets starting from a disk of planetesimals.

Interstellar medium: A study of the characteristics of the circumstellar gas and dust is key to understanding the origin of stars. Part of this gas and dust ends up in the rotating disk surrounding young stars, and forms the basic material from which icy planetesimals, and ultimately rocky and gaseous planets, are formed. Spectroscopic surveys of star-forming regions at different evolutionary stages, therefore, provide quantitative information on the building blocks available during planet formation. The Infrared Space Observatory (ISO) has provided the first opportunity to obtain complete infrared (IR) spectra 2.4 to 200 μm unhindered by the earth's atmosphere. The article on ISO spectroscopy of gas and dust: from molecular clouds to protoplanetary disks gives an overview of the subject.

Extragalactic astronomy and cosmology: Jets are highly relativistic, collimated, powerful outflows, and seem to be an ubiquitous feature of accreting black holes, and yet remain poorly understood. GRS 1915 + 105 is the first stellar-scale, highly relativisitic jet source identified, which is a key system for our understanding of the disc–jet coupling in accreting black-hole systems. Comprehending the coupling between inflow and outflow in this source is not only important for X-ray binary systems, but also has a broader relevance for studies of active galactic nuclei and gamma-ray bursts. The article on GRS 1915 + 105 and the disk-jet coupling in accreting black-hole systems reviews the observational properties of the system, and places it in context by detailed comparison with other sources. It constructs a simple model for the disc–jet coupling, which may be more widely applicable to accreting black-hole systems.

The chapter on EROs and faint red galaxies reviews the properties of faint IR-selected field galaxies and the extremely red colour-selected populations in particular. These populations are a mix of passively evolving stellar systems and heavily obscured star-forming galaxies. The star-forming component appears to constitute 20–50% of the population depending on the magnitude and colour cuts employed. The remaining objects are a mix of passively evolving ellipticals and early-type disk galaxies. The passively evolving red galaxies are strongly clustered in space and are likely the high-mass, high-luminosity end of the elliptical galaxy progenitor population at redshifts between one and two. These galaxies have masses and space densities that appear to be in conflict with late-forming hierarchical galaxy-formation models. The red galaxies appear to be a population that is distinct from the moderately star-forming Lyman–Break galaxies, but may be related to the star burst population at $z > 2$ seen in deep submillimetre surveys. The article on Secular evolution and formation of pseudobulges in disk galaxies reviews internal processes of secular evolution in disk galaxies.

All the articles in this volume present an up-to-date account of a variety of topics and list extensive references for further reading, which make this issue broad-based for one and all working in astronomy and astrophysics.

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Multiscale Methods in Quantum Mechanics: Theory and Experiment. Philippe Blanchard and Gian Dell'Antonio (eds). Birkhäuser, Boston, USA, 2004. 220 pp. Price not mentioned.

The book under review is a collection of papers presented at a meeting on 'Multiscale Methods in Quantum Mechanics: Theory and Experiment' held at the Academia dei Lincei in Rome during 16–20 December 2002. The theme of the meeting was to discuss the mathematical physics techniques of studying quantum mechanics of slow and fast degrees of freedom and other multi-scale phenomena. Discussion of the relevant experiments formed an integral part of the meeting. The quantum phenomena discussed ranged from the ones of interest in the foundations of quantum mechanics to those in the condensed matter physics and the quantum theory of structure of pyramidal molecules. The issues discussed included the questions of stability of three- and four-body Coulomb systems (by Martin), the quantum Boltzmann equation (by Pulvirenti), time evolution of bound states of classically non-integrable systems (by Robert), scattering of many non-interacting particles accounting for the exchange symmetry (by Dürr and Teufel), Schrödinger equation for double-well potential with a nonlinear perturbation (by Sacchetti) and asymptotic wave function of two particles interacting by δ-function potential (by Teta). The open problems associated with coloured

Hofstadter butterflies are discussed by Avron.

Since it provides a useful means of making contact with classical mechanics, the Wigner function representation of a quantum state has been used widely in the book. Recall that the Wigner function is a quasi probability phase-space distribution function, such that the average of a product of position and momentum variables with respect to it is equal to the average of the corresponding Weyl ordered position and momentum operators. By recasting the quantum evolution in terms of evolution of the Wigner function, a number of extensions of the classical results to the corresponding quantum systems are discussed (by Teufel and Panati). Used also is Bohm's formalism, wherein the classical concept of a trajectory is brought into play in quantum mechanics.

The interest in the theme of the meeting is due to the fact that there are several situations in physics in which different degrees of freedom of a system of many degrees of freedom, evolve on orders of magnitude different time-scales. The basis of the approximation methods for studying the phenomena on different timescales in classical mechanics is the adiabatic theorem. Its extension to quantum systems is, however, a non-trivial task. A familiar example of non-classical effect encountered while applying adiabatic approximation to a quantum system is the Berry's phase. It though turns out that Berry's phase is nothing but a special case of geometric phase which is independent of adiabaticity.

The important issues concerning the foundations of quantum mechanics addressed in the book are: What is the mechanism responsible for the emergence of classicality in quantum measurement? Is it possible to have Cat states, i.e. the superposition of macroscopic states? When can one observe effects which have no classical counterpart?

As is well known, and as various papers in the book argue, these questions are intimately related with the concept of coherence. It is the property of coherence between the states that leads to observable wave-like behaviour of particles. However, on interaction with the measuring apparatus, the system loses coherence between the eigenstates of the measured operator. Consequently, a measuring apparatus makes the system collapse to one of the eigenstates of the operator being measured. The loss of coherence may be attributed to the interaction between the system and continuously distributed infinite number of degrees of freedom that define a measuring apparatus. The new features that arise when one passes from a quantum system of finite number of degrees of freedom to the one having infinite number of degrees of freedom and its implications on the non-occurrence of Cat states in everyday life, is highlighted in the paper by Olkiewicz. Thus, though in principle, there is nothing against the occurrence of a Cat state, the absence of such states in our everyday experience results from the fact that, on interaction with the environment, such states lose their coherence on a timescale much shorter than that of observation. The fact that it is possible to prepare superposition of the states of a macroscopic (i.e. a classical) object and that it is the mechanism of decoherence that leads to the classicality of a quantum system, is demonstrated in the paper by Arndt *et al.* by means of description of experiments with nano-sized fullerene and porphyrins molecules which are good approximations to a classical object. The issues involved in classical versus quantum structures are underlined by Presilla *et al.* by means of the example of pyramidal molecules (like NH_3, molecules of the kind XY_3). Using examples of quantum cryptography and the process of stimulated emission, the paper by Scarani brings out similarities and differences between classical and quantum information. It underlines the fact that it is entanglement that distinguishes a quantum system from a classical one. For example, the properties of a single two-level quantum system are classical in the sense that they can be described in terms of a local hidden variables theory, but an entangled state of two or more two-level systems is non-classical in the sense that it does not admit a local hidden variable description. The non-existence of hidden variables theory in the case of two two-level systems is implied by violation of Bell's inequality. Such violations have indeed been seen in several experiments. Thus, it is entanglement that underlines characteristic quantum effects.

Since it is a collection of papers presented at a meeting of the experts, the book under review is for the benefit of hard-core mathematical physicists.

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