of this class of proteins in physiology and disease.

The *Annual Review of Cell and Developmental Biology* will be open access henceforth. This would be beneficial to students and early career researchers.

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Annual Review of Physical Chemistry, 2023. Todd J. Martinez and Anne B. McCoy (eds). Annual Reviews, 1875, S. Grant Street, Suite 700, San Mateo, California 94402, USA. Vol. 74. x + 571 pages. Price: Not mentioned.

Annual Review of Physical Chemistry is an edifying collection of articles highlighting the scientific advances in physical chemistry ranging from spectroscopy to computation. The authors of each article have clearly described the respective topics to provide the readers with a holistic view of modern research in physical chemistry. Each chapter encompasses a detailed elucidation of various concepts, theories and experiments associated with chemical systems, including excited-state modelling, many-body electron scattering and super-resolution fluorescence imaging.

The book starts with a tribute to Phillip L. Geissler, the distinguished theoretical chemist who made important contributions to the field of statistical mechanics of biological polymers, heterogeneous materials, and chemical dynamics in aqueous environments. The chapter 'Remembering the work of Phillip Geissler: a coda to his scientific trajectory' discusses the seminal work of Geissler in developing models and analytical and computational methods to understand the dynamics of water and biopolymers like DNA and proteins, nanoscale self-assembly, structural and compositional transformations of nanocrystals, and formation of nanomaterials. The remaining chapters of the book mainly fall into categories such as photochemistry, nanomaterials and theoretical chemistry.

Spectroscopy is a powerful tool in photochemistry that helps unravel the static and dynamic behaviour of molecules. In the chapter titled 'Gas-phase computational spectroscopy: the challenge of the molecular bricks of life', the authors discuss the challenges in the theoretical modelling of molecular bricks of life, e.g. DNA bases or amino acids and prospects of *a priori* predicting the spectral signatures of medium-size molecules in the gas phase with particular emphasis on rotational and vibrational spectroscopies. The chapter 'Ultrafast X-ray probes of elementary molecular events' discusses the importance of analysing the fast processes that occur during photochemical reactions and how they affect the functionality of molecules. The authors specifically focus on non-adiabatic dynamics, which occur at conical intersections and involve rapid transitions between electronic states in molecules. The chapter 'Spectroscopic studies of clusters of atmospheric relevance' reviews the spectroscopic investigations of atmospheric aerosols, focusing on secondary particles to understand the intermolecular interactions governing the mechanism of particle formation and growth. Vibrational spectroscopy and electron spectroscopy have played pivotal roles in revealing acid-base interactions in small clusters consisting of vapours that accelerate new particle formation, elucidating the structures of growing clusters, and exploring the complex process of cluster hydration. In the chapter titled 'Studies of local DNA backbone conformation and conformational disorder using site-specific exciton-coupled dimer probe spectroscopy', reviews the application of recently developed spectroscopic methods and analyses that combine linear absorbance and circular dichroism spectroscopy with nonlinear 2D fluorescence spectroscopy. The prime focus of the review is on the utility of these spectroscopic techniques to investigate the local conformations and conformational disorder of the sugar-phosphate backbones of ssDNA–dsDNA fork constructs that have been internally labelled with exciton-coupled carbocyanine dimer probes. The chapter '*In situ* measurement of evolving excited-state dynamics during deposition and processing of organic films by single-shot transient absorption' highlights the importance of understanding the photophysics of organic thin films in semiconductor devices and how their deposition and processing methods affect their electronic structure and excited-state dynamics. In the chapter 'Photodarkening, photobrightening, and the role of color centers in emerging applications of lanthanide-based upconverting nanomaterials', fundamental aspects and emerging functionalities enabled by colour centres within Ln-doped nanocrystals are being focussed. The distinctive characteristics of colour centres within Ln-doped nanocrystals offer diverse applications in afterglow-based bioimaging, X-ray detection, inorganic nanocrystal photoswitching and fully rewritable optical patterning and memory. The chapter 'Photochemical up conversion (PUC)' provides an extensive overview of PUC research, covering spin physics, photophysics, design considerations and enhancement approaches. It also focuses on the emerging field of sensitizing PUC using bulk semiconductors and its impact on hybrid opto-excitonic devices. The chapter 'Ultrafast dynamics of photosynthetic light harvesting: strategies for acclimation across organisms' outlines the fundamental aspects of light-harvesting systems, energy transfer principles, and relevant time-resolved spectroscopic tools focusing on the acclimation mechanisms of three classes of photosynthetic organisms (purple bacteria, cyanobacteria and green plants) to variations in light, temperature and nutrients. Furthermore, concepts belonging to the sub-domains of applied photochemistry and bioimaging are also described chapter-wise. The chapter 'Photoacid dynamics in the green fluorescent protein', explores proton tunnelling in the electronic ground state and the excited-state proton-transfer reaction taking place in the picosecond timescale in green fluorescent protein. The chapter '3D super-resolution fluorescence imaging of microgels' details how modern super-resolution fluorescence microscopy techniques enable visualization of single microgels and give new insights into the shape, morphology, internal compartmentalization, cross-linker density, polarity and deformation of microgels, and in general soft polymer materials.

Nanomaterials can take on unique optical, magnetic, electrical and other properties. These emergent properties have the potential for great impacts in electronics, medicine and other fields. The chapter 'Magneto-optical properties of noble metal nanostructures' discusses the connection between the magneto-optical signatures of colloidal noble metal nanostructures and their various applications, such as photonic integrated circuits and applied spectroscopy. It highlights how electron doping and single-atom substitution affect the magneto-optical response and transient spin polarization of nanoclusters. The chapter titled 'Adsorption at nanoconfined solid–water interfaces'

features the importance of need for comprehending the reactions at solid–water interfaces and how they are affected by nanoconfinement. The review evaluates recent advances in experimental and theoretical studies on adsorption at solid–water interfaces and discusses the implications and future research directions in this field. The chapter 'Mechanisms of photothermalization in plasmonic nanostructures: insights into the steady state' discusses how localized surface plasmon resonances in metallic nanostructures enhance light–matter interactions and aid surface spectroscopies. It also explores the physics and dynamics governing the photothermalization process and the optimization of plasmonic systems for low-intensity, continuous illumination applications.

Computational chemistry deals with the implementation of quantum mechanical, molecular mechanical or hybrid methods to model the structure, function, dynamics and reactivity of molecules while theoretical chemistry deals with the development of new methods or computational techniques improving the accuracy and speed of chemical calculations. The book also covers phenomenal works from various theoretical and computational research groups, including the development of cutting-edge quantum theory and performance of massive simulations. 'The predictive power of exact constraints and appropriate norms in density functional theory' explores the exchange and correlation holes and discusses the known constraints on exchange-correlation energy. Through the analysis of progressively sophisticated density functional approximations, the article suggests the importance of incorporating more precise constraints and suitable norms to enhance the predictability of a function across the vast landscape of many electron systems. 'Modelling anharmonic effects in the vibrational spectra of high-frequency modes' reviews contemporary theoretical strategies designed to support and direct the analysis of data embedded in high-resolution vibrational spectra. 'Toward *ab initio* reaction discovery using the artificial force induced reaction method' outlines the authors' success in *ab initio* prediction of chemical reactions, providing an overview and examples. The forward search predicts the yield and reveals a comprehensive picture of a chemical reaction. Meanwhile, the backward search predicts various chemical reactions, including known ones, along with their yields. The chapter 'Interactive quantum chemistry enabled by machine learning, graphical processing units, and cloud computing' addresses removing barriers in modern quantum chemistry algorithms, such as domain expertise, programming skills, and powerful hardware and discusses leveraging cutting-edge technologies to democratize quantum chemistry. The focus is creating accessible platforms for real-time quantum chemistry computations, featuring elements like GPU-accelerated quantum chemistry in the cloud, AI-driven natural molecule input methods, and extended reality visualization. Interaction analysis techniques like many-body expansion, symmetry-adapted perturbation theory, and energy decomposition offer insights into complex molecular interactions. The chapter 'Many-body effects in aqueous systems: synergies between interaction analysis techniques and force field development' explores the synergy between these techniques and advanced force fields, particularly *ab initio*-based ones fitted to high-level electronic structure results. The chapter 'The optical signatures of stochastic processes in many-body exciton scattering' examines a quantum stochastic model for spectroscopic line shapes that includes a non-stationary background population of excitations. It explains the derivation of a reduced model and presents an overview of the theoretical techniques for predicting coherent nonlinear spectroscopic signals. The chapter 'Modeling excited states of molecular organic aggregates for optoelectronics' delves into excited-state processes within aggregate states and explores prevalent atomistic models and electronic structure techniques to comprehend light-activated phenomena in molecular aggregates, encompassing both radiative and nonradiative decay pathways. The article explains different nonradiative decay channels like internal conversion, intersystem crossing, singlet fission, etc. and the transport mechanism of excitation energy in molecular aggregates, which is crucial for optoelectronic applications.

Apart from these, the review also contains chapters that deal with thin film fabrication and elemental studies of atmosphere. The chapter 'Surface-mediated formation of stable glasses' discusses the need for further exploration and understanding of surface-mediated solid–glass formation, including the influence of surface and glass layer dynamics, enhanced ageing rate and mobility profiles. It also investigates the potential for controlling mobility and structure in thin films to develop new materials and study hidden-phase transitions. The authors emphasize the need for new experimental methods and extended simulations to examine mobility profiles on various surfaces. The kinetic and photolysis isotope effects involved in understanding the isotope compositions of atmospheric ozone, carbon dioxide, methane, nitrous oxide and other gases and their historical context are discussed in the next chapter, 'Isotope effects and the atmosphere'. A concise overview of non-mass-dependent isotope compositions of oxygen-containing species and the recent growth of clumped isotope measurements at natural isotopic abundances is also provided.

In summary, *Annual Review of Physical Chemistry 2023* is a collation of well-articulated research happening across the world, spanning a wide area of physical chemistry. The reviews by the authors effectively help enhance the readers' understanding of the research problems under investigation. The framing of each chapter is impressive with respect to the flow and organization of article content, as well as the conciseness in explaining intricate information. All scientific statements are well-developed, succinct, accurate and unbiased. The authenticity and overall quality of the review are appreciable.

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