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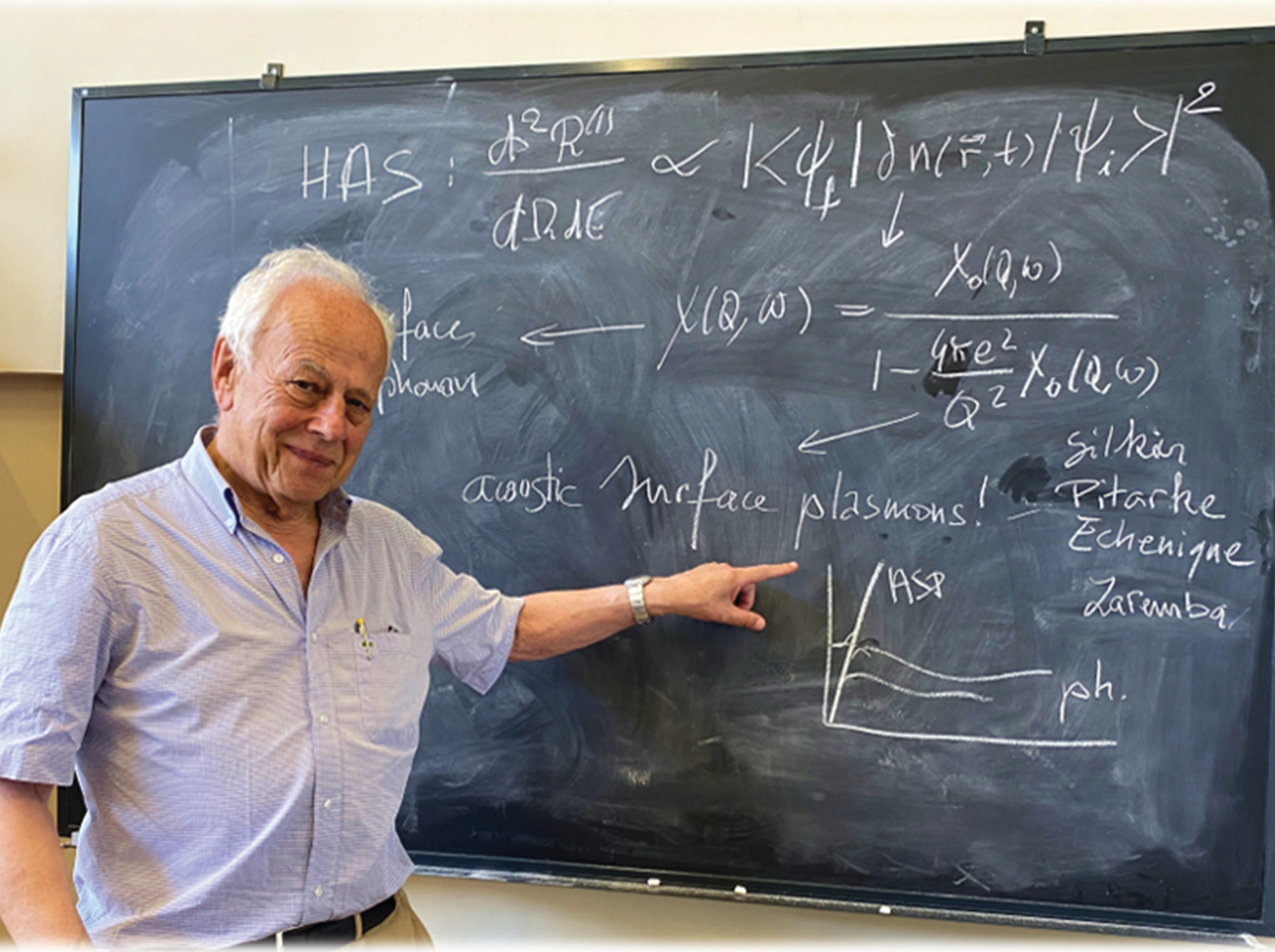

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EDITORIAL

Marco Bernasconi *et al.*
New trends and challenges in surface phenomena, carbon nanostructures and helium droplets – Festschrift for Giorgio Benedek

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New trends and challenges in surface phenomena, carbon nanostructures and helium droplets – Festschrift for Giorgio Benedek

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This special issue of *Physical Chemistry Chemical Physics* is a themed collection in honor of Professor Giorgio Benedek to celebrate the occasion of his eightieth birthday, and is entitled "New Trends and Challenges in Surface Phenomena, Carbon Nanostructures and Helium Droplets". This title represents the many research fields pioneered and tackled by Giorgio over his past and present scientific career. More than 40 papers presented here are authored by his former students, postdoctoral associates, research colleagues and scientific admirers and friends.

Appropriately "surface phenomena" are listed first in the above title. Giorgio's early prediction of the dispersion curves of surface phonons was instrumental in initiating the field of elementary atomic scale dynamics at surfaces. His many subsequent contributions to the study of surface phenomena, in particular elementary surface vibrational excitations, stimulated the development of new techniques for high-resolution inelastic helium atom scattering (HAS) and electron energy loss spectroscopy (EELS) to measure the dispersion curves of surface phonons in insulators, semiconductors and metals. This special issue features Perspective articles on the theory of atom-surface scattering and on the most recent applications of high resolution EELS to the study of several surface excitations. Also described in this collection is the latest method of ^{3}He spin-echo spectroscopy, which has unequalled resolution. Other important surface physics phenomena to which Giorgio made important contributions to which are addressed by articles in this volume, are the dynamics of vicinal (stepped) surfaces and molecular layers grown on metal surfaces. The impressive amount of work and progress carried out in the field of surface phonon theory and spectroscopy is marked by several relevant trends which have emerged during the last decade. Among those addressed by this special issue are the investigation of electron–phonon interactions in ultrathin metallic films and in topological insulators and semimetals which feature the presence of topologically protected electronic surface states with peculiar transport properties. They have important relevance in many key dynamical and chemical processes at surfaces, including heterogeneous catalysis. The role of surface dynamics in these

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processes has been conjectured since the early days, though only recently the above studies have provided a sound microscopic basis.

A second field to which Giorgio Benedek has made important contributions is the study of carbon nanostructures. The great excitement in the 80's and 90's following the discovery of new carbon forms (fullerene and nanotubes) and the isolation of graphene, spurred the entirely new field of research on 2D materials. In the last decade carbon nanostructures have been exploited in several fields of application such as electronics, biotechnology and energy storage. This in turn has stimulated very intense basic research on the structural, electronic and vibrational properties of carbon nanostructures. Giorgio and his group found many novel 2D carbon materials. Among novel carbon materials addressed by articles in the special issue are *graphdiynes*.

The third research line, pioneered by Giorgio together with Peter Toennies concerns the dynamics of superfluid helium nanodroplets. In classic papers, bosonic and fermionic collective excitations and their relation to superfluidity of finite-sized helium droplets were reported. Quantum liquid droplets and their spectroscopy *via* doping chromophore molecules have emerged as another active field of research reported in this collection.

In addition to Giorgio's remarkable pioneering scientific accomplishments in many different emerging fields, another reason for the resonance in the scientific community, as expressed by the large number of contributions to this themed collection, is that many of us regard Giorgio as a mentor and guide and for some of us as an invaluable colleague and reference at the theoretical level. We admire his intellectual brilliance, inventiveness coupled with a cartoonists sense of humour and gentlemanly generosity in sharing his ideas with others. We, the undersigned Guest Editors of this themed collection, have had the great fortune to have known him as a valued collaborator and a close congenial friend.

In closing, we would like to express our thanks to all the contributing authors for the time and effort they have spent in making this an exceptional collection of papers. We would also like to thank the editors of *Physical Chemistry Chemical Physics*, Colin King and Isobel Tibbetts, for their encouragement and generous efforts in making this themed collection possible.

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