Molecular Physics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tmph20

Robert Evans FRS
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Available online: 29 Apr 2011

To cite this article: Jean-Pierre Hansen & Christos Likos (2011): Robert Evans FRS, Molecular Physics, 109:7-10, 997-998
To link to this article: http://dx.doi.org/10.1080/00268976.2011.564464

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Bob Evans, H.O. Wills Professor of Physics at the University of Bristol, will celebrate his 65th birthday on April 7th, 2011. On this occasion, Molecular Physics, a journal that has published many of his ground-breaking papers, is delighted to dedicate a Special Issue to the leading authority on the Statistical Mechanics of Fluid Interfaces and Confined Fluids.

We have received an enthusiastic response from many of Bob’s past and present collaborators, friends and admirers, resulting in a particularly rich issue containing 33 papers that cover a very broad range of topics dealing with surface structure, thermodynamics and phase transitions, colloid physics and related areas, which Bob pioneered for nearly 40 years.

Bob was born near Durham, trained at A.J. Dawson Grammar School in Wingate, before obtaining a BSc in Mathematical Physics from the University of Birmingham in 1967. From there he moved to the H.H. Wills Physics Laboratory at the University of Bristol to work under the supervision of Professor John Ziman towards a PhD, which he obtained in 1970. Bob has remained at Bristol ever since, except for sabbatical leave abroad, including visits to the Max Planck Institut für Metallforschung near Stuttgart as holder of a prestigious Humboldt Award. In 2005 he was elected Fellow of the Royal Society, and in 2006 he was appointed head of the Bristol Physics Department; he very recently stepped down to return to full-time research, and we are told that his exceptional commitment and leadership as HOD are sorely missed by all his colleagues. Bob will spend the first few months of his ‘retirement’ as Kramers Visiting Professor at Utrecht University, where he will deliver the prestigious Kramers Lectures. While it is impossible to do justice to all of Bob Evans’ ground-breaking achievements in this short preface, we will attempt to summarize some of his most important contributions.

Bob’s early work as a PhD student and a young scientist dealt mostly with the electronic transport properties and the ionic structure of liquid metals, extending, in particular, the classic Faber–Ziman theory to increasingly complex metallic systems, including transition metals, alloys and iron under extreme geophysical conditions. Early on, Bob became interested in the surface properties of metals, including the surface energy, surface tension, and their relation to ion and electron density profiles. In fact, one of us (JPH) first met Bob at a pioneering Summer School on liquids, held in 1977 in Aleria (Corsica), at the holiday camp run by the French Union of prison guards, close to the beach, but also to a penitentiary, complete with a nocturnal escape! Despite the excitement, Bob delivered a remarkable series of lectures on the electronic structure theory of liquid metals with his trademark gusto and wit.

Shortly thereafter he wrote his celebrated review article on inhomogeneous classical fluids, published in Advances in Physics (1979). Building on the classic work of Hohenberg, Kohn and Mermin on quantum density functional theory of the inhomogeneous electron gas, as well as on early attempts by Jerry Percus, Bob laid the foundations of the modern density functional theory (DFT) of classical fluids and their interfaces. The 1979 review is characteristic of Bob’s clarity and depth, and of his ability to strike in his work the right balance between mathematical rigour and physical insight. As such, it has been, ever since its appearance, the standard work of reference for anyone interested in classical DFT, and it is equally suited both for beginners in the topic and for experienced researchers. In fact, it was the first article one of us (CNL) had to read and understand as a requirement for starting his doctoral work on classical fluids, a practice he is happy to continue applying to his own PhD students. This highly cited landmark paper was followed by a cascade of applications of DFT to the calculation of density profiles and interfacial thermodynamics of simple fluids and their mixtures, and of ionic fluids. This in turn led to Bob’s classic papers on adsorption, layering transitions, wetting and drying transitions at solid–fluid and fluid–fluid interfaces, many of which were published in Molecular Physics in the early and mid-eighties. More recently, this led to Bob’s only encounter with the Devil, embodied in curved substrates.

In the mid and late eighties, Bob and his collaborators turned to the investigation of fluids confined in pores and the phenomenon of capillary condensation,
which has many practical implications. More specifically, Bob analysed critical point shifts in confined liquid films, the competition between pore wetting and phase equilibria, the influence of capillary condensation on near-critical solvation forces, and much more. The subject also provided him with the opportunity of a close collaboration with an experimental group using Positronium Annihilation techniques to characterise fluids adsorbed in pores.

In the early nineties, Bob developed a rigorous analysis of the decay of pair correlations in neutral and ionic fluids. He also developed the DFT of ‘small’ systems, i.e. of tiny amounts of fluid confined in narrow cavities, where different statistical ensembles are no longer equivalent.

In the late nineties, Bob turned his attention to mesoscopic colloidal systems and other complex fluids. He initiated a rigorous analysis of depletion interactions in colloid–polymer mixtures (Asakura–Oosawa model) and in asymmetric binary colloidal hard-sphere mixtures, where the smaller component plays the role of depletant. Bob and his collaborators investigated the role of depletant. Bob and his collaborators investigated the validity and limitations of using effective (entropic) interactions between the large colloidal spheres, obtained by averaging over the degrees of freedom of the smaller component. Such coarse-graining allows phase diagrams to be mapped out at much less computational cost, and to attain asymmetry ratios that would lead to severe ergodicity problems in a fully two-component representation. Among other complex fluid problems, Bob studied orientational wetting and capillary nematisation of confined liquid crystals, and the bulk and interfacial properties of binary star-polymer solutions.

This short and incomplete overview will at least convey a taste of the breadth and depth of Bob’s research interests, and of the enormous impact of the powerful DFT tool on many aspects of molecular and colloidal fluids and their interfaces. Bob’s papers are always a pleasure to read, and convey a strong impression of rigour, clarity and deep physical insight. Without Bob’s leadership, commitment and intuition, the understanding of fluid interfaces and surface phase transitions would not have advanced so potently over the past three decades, and much further progress will be achieved in the future by following Bob’s footsteps. The growing community of liquid and soft matter scientists owes Bob Evans enormous gratitude.

On top of being an outstanding scientist, Bob is an extremely friendly and helpful colleague, with a pleasantly sharp mind and a kind and witty personality. He is universally liked and respected, and his very British sense of humour adds extra spice to his very popular lectures and presentations. Bob, as spokesman of the large, world-wide community that you have been instrumental in shaping and inspiring over the years, we wish you a Happy Birthday, and a very active and pleasant ‘retirement’ in Margaret’s company.

Jean-Pierre Hansen and Christos Likos