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Editorial

Bubble dynamics in champagne and sparkling wines: Recent advances and future prospects

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"Come quickly brothers, I am drinking stars!" The quote is attributed to Dom Pierre Pérignon (Fig. 1), a French Benedictine monk, cellar master at the Abbey of Hautvillers (near Epernay, in the heart of the Champagne region), on tasting a wine made sparkling by accident for the first time. But even if it is now generally accepted that much of this story is fiction, champagne has been the most renowned French sparkling wine, praised world-wide for the fineness of its effervescence (the very much sought-after bubbling process). Despite the huge body of research, initiated by Louis Pasteur in the 19$^{\text{th}}$ century, aimed at progressively unlocking wine science in general, only quite recently much interest was devoted to depict each and every parameter involved in the bubbling process characteristic of champagne and sparkling wines.

Bubbles are indeed very common in our everyday life. They play a crucial role in many natural as well as industrial processes (in physics, chemical and mechanical engineering, oceanography, geophysics, technology, and even medicine). Nevertheless, their behavior is often surprising and, in many cases, still not fully understood. Since the past decades, a large body of research has been devoted to bubbles and foams dynamics. Otherwise, and rather surprisingly, physical and chemical processes behind the formation of bubbles in Champagne wines (and more generally in sparkling beverages) remained completely unexplored until the late 1990s. In the small volume of a champagne flute, each and every step of a fleeting bubble's life can be found. Bubbles arise through non-classical heterogeneous nucleation. They grow in size while rising through the liquid surface, where they finally collapse in a very complex and visually appealing mechanical process, leading to the projection of fast-traveling droplets of wine. Each of these steps deserves particular attention in order to better understand how bubble dynamics enhance the perception of aromas under standard tasting conditions. The first part of this volume describes in minute details the journey of yeast-fermented CO_2, from grape harvest to the nucleation and rise of gaseous CO_2 bubbles in the flute, including the thermodynamic equilibrium of CO_2 within the sealed bottle, and the fascinating cork-popping process. It is an extension of an earlier review published by Gérard Liger-Belair in EPJST in 2012 [1], complemented

Fig. 1. Statue of Dom Pérignon standing in front of champagne Moët & Chandon, in Epernay (Victor Grigas).

with several and significant recent advances. The second part of this volume is a tutorial review deciphering the process behind the collapse of bubbles, mainly based on recent advances conducted by a team of fluid physicists from Institut Jean Le Rond d'Alembert (in Paris 6), led by Dr. Thomas Séon. Let's hope that your enjoyment of champagne will also be enhanced after reading these two tutorial reviews dedicated to the science hidden right under your nose each time you enjoy a glass of bubbly!

Gérard Liger-Belair and Thomas Séon

Reference

1. G. Liger-Belair, Eur. Phys. J. Special Topics **201**, 1 (2012)

Gérard Liger-Belair:

Gérard Liger-Belair received his PhD in physical sciences in 2001 from the University of Reims Champagne-Ardenne (France). He received an associate professor position in 2002, and a full professor position, in 2007, in the same University. He has been researching the physics and chemistry behind the effervescence of champagne and sparkling wines for several years. His current interests include the science of bubbles, foams and thin films, and their broad interdisciplinary applications. He is the author of several academic and popular science books. His first book, Uncorked: the science of champagne, published by Princeton University Press, won the 2004 award for the Best Professional/Scholarly Book in Physics from the Association of American Publishers.

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Thomas Séon is a CNRS researcher, working on physical hydrodynamics problems at Institut Jean le Rond d'Alembert, University Pierre et Marie Curie (France). He carried out his PhD between 2003 and 2006, under the supervision of Jean-Pierre Hulin, working on mixing and gravity currents. Then, he spent four years abroad, at the University of Chile in Santiago de Chile and University of British Columbia, in Vancouver, Canada. He currently works on different topics including bubble and drop dynamics, phase transition and cracks.