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EDITORIAL

Editorial: Topical Collection 'complex interactions with droplets'

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Droplets have fascinated and attracted researchers in the field of fluid mechanics for at least 150 years, because they reveal a plethora of spectacular phenomena and shapes, sometimes as perfect as celestial spheres, and sometimes tremendously more complex and ephemeral. Such an abundance stems from the fact that these small liquid bodies are an easily visible tip of hydrodynamics of transient three-dimensional flows with free surfaces. Moreover, multiple physical processes result in droplet formation, numerous contact and contactless ways to manipulate them, and myriads of industrial applications of droplets, as well as natural phenomena strongly affected by them, make complex interactions with droplets a subject of significant importance and relevance.

Accordingly, the present Topical Collection encompasses 17 experimental studies covering numerous topics, many of which sound unrelated, but nevertheless are closely linked through their focal points—droplets. For example, blood pattern analysis (BPA) in forensic science has gained increasing attention in fluid mechanics and poses intriguing fluid mechanical problems (R. Faflak & D. Attinger, Do impact spatters depend on impact velocity, impact energy or impactor shape?). Such a dangerous and detrimental (in the industrial context) phenomenon as icing is intrinsically related with droplet impact, freezing and solidification (M. Gloerfeld et al., Measurements and modelling of the residual mass upon impact of supercooled liquid drops; M. Stiti et al., Characterization of supercooled droplets in an icing wind tunnel using laser-induced fluorescence). Water aerosolization by vibrating dental tools (cavitron scalers operating in the kHz range) could result in tiny airborne droplets carrying viruses, as the studies triggered by the recent COVID-19 pandemic elucidate (E.A. Haffner et al., An experimental approach to analyze aerosol and splatter formations due to a dental procedure), while individual droplets could also be manipulated by oscillations in the MHz range (P. Brunet & M. Baudoin, Unstationary dynamics of drops subjected to MHz-surface acoustic waves modulated at low frequency). Droplet nucleation and precipitation have already revealed such spectacular phenomena as Ostwald ripening and the corresponding seminal Lifshitz–Slyozov–Wagner theory; still the research in this field is driven by multiple novel industrially important applications (M.M. Campagna et al., Critical cluster composition from homogeneous nucleation data: application to water in carbon dioxide–nitrogen carrier gases; H. Cao et al., Micro-droplet deposition and growth on a glass slide driven by acoustic agglomeration). Droplet shape and adhesion on fibers are important in nature, as well as in textile and nonwoven applications, and experimental research in that field involves elements of ferrohydrodynamics (M. Jamali & H.V. Tafreshi, Studying droplet adhesion to fibers using the magnetic field: a review paper). Droplet evaporation on solid surfaces of different degrees of wettability and the evaporation-driven internal flows in droplets are, as usual, in focus (A. Alperen Günay et al., Droplet evaporation dynamics on microstructured biphilic, hydrophobic, and smooth surfaces; T. Josyula et al., Internal flow in evaporating water drops: dominance of Marangoni flow), while a recently introduced droplet impact onto surfaces driven by supersonic gas flow comprises a novel, actively developing branch of materials science aiming at formation of nanotextured surfaces (S. An et al., Review of recent progress in the supersonic cold-spraying technique with solid particles and liquid suspensions). Droplet impacts onto liquid films and solid surfaces is still full of interesting observations and intriguing questions (Y. Wu et al., A comparative study of the immiscibility effect on liquid drop impacting onto very thin films; J. Zhu, Behavior of a water droplet impacting a thin water film; X. Lin, 3D visualization of droplet splashing dynamics with high-speed digital in-line holography). Methodological aspects of the experiments with droplet impact onto liquid films on the wall are also in focus (T. Kurniawan et al., Practical notes toward higher

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quality and more reliable experiments on drop and liquid surface interactions).

Bubbles can be characterized as anti-droplets, which reveal interesting dynamics of impacts onto liquid–liquid interfaces (K. Choi & H. Park, Interfacial phenomena of the interaction between a liquid–liquid interface and rising bubble). The acoustically driven droplet jetting technology is a novel path in printing applications in microelectronics and biomedicine (Y. Lei et al., High-order modal acoustic wave driving vertical jetting of droplets on 128° Y–X $LiNbO_3$).

The present Topical Collection not only depicts the abundant modern directions of the experimental research in the field related to droplets and their interactions with solid and liquid surfaces, as well as the acoustic and electromagnetic fields, but can also serve as an inspiration for plenty of new directions in this fascinating, unlimited subset of the three-dimensional transient hydrodynamics with free surfaces.

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