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Foreword

Catherine Colin, Guillaume Legros

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Catherine Colin and Guillaume Legros

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Guest editors: Olga Budenkova (CNRS, Université Grenoble Alpes,Grenoble INP, SIMaP, 38000 Grenoble, France), Catherine Colin (IMFT, Université de Toulouse, CNRS, INPT, UPS et GDR 2799 Micropesanteur Fondamentale et Appliquée) and Guillaume Legros (ICARE, CNRS UPR 3021, Univ. Orléans et GDR 2799 Micropesanteur Fondamentale et Appliquée)

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Physical Science in Microgravity within the Thematic Group Fundamental and Applied Microgravity / *Sciences physiques en microgravité au sein du GDR Micropesanteur Fondamentale et Appliquée*

Foreword

Catherine Colin [a] **and Guillaume Legros** [b]

[a] IMFT, Allée Camille Soula, 31400 Toulouse, France

[b] CNRS-ICARE / Univ. Orléans, 1C Avenue de la Recherche Scientifique, 45071 Orléans Cedex 2, France

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As the editors of this special issue, we are delighted to introduce a selection of recent achievements associated with the French Research Network (*Groupement de Recherche*) on Fundamental and Applied Microgravity (GdR CNES/CNRS 2799). Last year marked the 30th anniversary of this group, making it the longest-standing GdR accredited by the *Centre National de la Recherche Scientifique* (CNRS). To open the 4th decade of our group, the *Comptes-Rendus Mécanique de l'Académie des Sciences* offered the invigorating opportunity of this special issue.

Over the past 30 years, a dedicated French aircraft has played a crucial role in evaluating theoretical and numerical investigations through experimental work conducted during parabolic flights to simulate microgravity conditions. From the initial *Caravelle* in the 90's to the current *Airbus A310*, three airplanes were specifically equipped to be full-time dedicated to parabolic flights. As highlighted in the first paper of this special issue, these facilities located on the French ground show—among others—the unfailing support of the French Space Agency (*CNES*) which we celebrate here.

Many processes are affected by gravity, and our understanding may be blurred by some gravitational effects. As an appealing illustration, the cover page displays a sequence of frames captured by a fast camera imaging the onset of an instability that propagates over the initially smooth sheet of an expanding premixed spherical flame. For sure, the directional feature of buoyancy makes it a serious trigger leading to the onset. So what if this trigger vanishes? Throughout a wide range of fields related to mechanics, the present issue compiles recent advances that pave the way to further understanding of fundamental processes, such as phase change or complex flows in the absence of gravity.

In the coming decade, space exploration that is clearly ambitioned by the major space agencies today also pushes new perspectives into our group. For this reason, our community now contributes at an international level to projects aiming at spacecraft safety or life sustainability. Papers related to fire safety or plant growth illustrate here these contributions.

Beyond these crucial issues, we also intend to celebrate a human adventure that a few generations of scientists strongly committed to. With this respect, we are deeply grateful to Christophe Delaroche, who retired one year ago after years serving as the Head of the Physical Sciences in

microgravity Department at CNES. We also express a moved homage to our colleague Professor Pierre Haldenwang who passed away two years ago after serving two terms as president of our group. We are convinced that Pierre's inspiring spirit will continue to guide our work for a long time. At the very least, the birth of our brand new website echoes this will:

https://gdr-mfa.fr/

Catherine Colin
Director of French Research Network on Fundamental and Applied Microgravity
France
colin@imft.fr

Guillaume Legros
Deputy director of French Research Network on Fundamental and Applied Microgravity
France
guillaume.legros@cnrs-orleans.fr