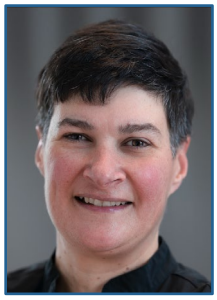
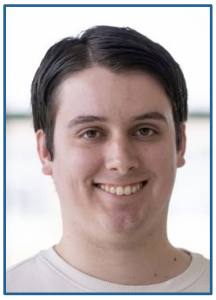
PHYSICS, CLIMATE AND THE TRANSITION TO SUSTAINABILITY

Pierre Bénard, Kris Poduska, and Jake Breen, Guest Editors, *Physics in Canada*

Understanding the mechanisms responsible for climate change and the capacity to predict its impact on ecosystems is essential for devising strategies to counteract or manage these changes—whether through policy action or the development of new environmental technologies. This task is fundamentally multidisciplinary, yet physics plays a significant role that often goes unrecognized.

The contribution of physics to the field of climate change can be broadly categorized into two domains. First, physics is crucial to understanding the underlying mechanisms—whether anthropogenic, atmospheric, geological, or astronomical in origin – including the analysis of how matter and energy flows resulting from human activity impact the environment at all scales. Second, physics plays a key role in developing the new materials, devices, and systems required for technologies that facilitate the energy transition.

These activities span a wide range of physics disciplines, crossing subdisciplines. In addition to core physics fields, they encompass atmospheric physics, geophysics, statistical physics, fluid mechanics, condensed matter physics, thermodynamics, and even astrophysics.

With this special issue of *Physics in Canada*, we aim to showcase the work of physicists in the fields of climate change and ecological transition technologies—areas that are growing in importance but remain, in our view, underrepresented in Canada. We therefore present an overview—necessarily incomplete—of the field through various contributions from fellow physicists across Canada.

In this special issue, there is an example of a climate tipping point by examination of the historical context and physical underpinnings of the hypothesis regarding the collapse of the Atlantic Meridional Overturning Circulation. Another article offers a discussion on the physics of contrails and their impact on climate change. The issue continues with a contribution on how physics enables a better understanding and prediction of severe storms to help mitigate their impacts, and another on the influence of climate cycles on the formation of specific patterns and landforms in the Canadian Arctic. Next, we examine how to quantify and characterize the environmental impact of our energy system through an article on the role of energy system modeling in developing decarbonization strategies to combat climate change.

We also recognize that climate change and the energy transition are changing physics education and training. In this context, there is an interview featuring an early-career researcher and two professionals in the field, discussing the challenges associated with research and researcher training in such a complex, multidisciplinary area. Additionally, there is a contribution from colleagues specializing

in physics education; they discuss how to incorporate atmospheric and environmental physics—subjects relevant to the research activities of approximately 20% of the faculty but traditionally underrepresented in university experimental curricula—into experimental physics courses.

We hope this special issue will illustrate the role physicists play in the energy transition and raise awareness of Canadian contributions to both climate change mitigation and adaptation.

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Comments of readers on this Foreword are more than welcome.