

Editorial*

Nandini Nagarajan, Guest Editor

The celestial spectacle of the aurora dazzled and bemused humans for centuries until the 19th century, when links between the Sun's activity and aurora were established. Both laboratory studies of the bombardment of the Earth by charged particles, and advances in understanding the forces generated by the Earth's magnetic field, led to breakthroughs, postulating the presence of a stream of charged particles issuing from the Sun and their interactions with the Earth's magnetic field. Awe and wonder at the auroral spectacle changed to a deeper understanding of solar-terrestrial interactions, and theories were evolved, discussed, and debated in the early 20th century. Space exploration in the later half of the century has provided a resounding validation, as well as refinement of these earlier theories. One such substantial contribution was the study of aurora over 40 years by Carl Stormer. Carl Stormer was a pioneer in the study of the aurora in particular and mathematics and geomagnetism in general. He held a chair of mathematics at Oslo University for 43 years. The ambit of such a chair was wide enough for him to devote himself to finding mathematical expressions of trajectories of charged particles, leading to a lifelong study of the aurora borealis. It was in the nature of this interdisciplinary discourse at Oslo University that he followed up the terella experiments of Birkeland with his mathematical formulation of trajectories and, further, embarked on photographic observations to study the formation, morphology, and spectral content aurora, that spanned almost 45 years (4 solar cycles). Details of the life and work of Stormer are gleaned from the immaculate record-keeping in personal diaries, newspapers, and scientific reports, in Norwegian society. Remarkably, Stormer enjoyed a free hand to devote himself and considerable resources of



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the Norwegian Government to pursue his research on the aurora. It is no wonder since the same Norwegian society and government supported and funded the polar explorers Nansen and Amundsen in the early 20th century. Among Stormer's many achievements, two that stand out are his work photographing, classifying and describing the aurora and his formulation of allowed and forbidden trajectories from infinity into the Earth's magnetic fields. Many other ideas flowed out of this body of work, and Stormer was a distinguished geophysicist and mathematician of his time. With present-day planetary and deep space exploration, the application of his mathematical formulations to model magnetic flux and charged particles around other planets and stars have gained significance.

The May issue of this journal highlights the work of Carl Stormer, a gifted mathematician, who turned his attention to geomagnetism, the life and writings of Evelyn Hutchinson, who is known as the father of modern ecology, and also marks World Metrology Day.

There are six general articles in this issue on topics ranging from biopolymers to mathematical modeling of the novel coronavirus. The article 'Turning the Spotlight on Biopolymers and Carbonized Biomass for Environmental Remediation' by N Rajesh is a concise write-up emphasizing the growing need to develop eco-friendly materials to sequester diverse contaminants from wastewater. Tailoring biopolymers with non-toxic metal oxides and carbonization of biomass are aspects described here.

Rajarshi Ghosh writes eloquently about the ubiquitous 'Bunsen Burner' in his article. This is a fascinating glimpse into the significance of the Bunsen burner and its uses. Applications of the Bunsen burner extend to atomic absorption spectroscopy and atomic emission spectrometry. It is indispensable in several aspects of experimental chemistry as it produces both oxidizing and reducing flames in a single set-up. Bunsen burner is not only used academically for teaching and learning but also estimations at the industrial scale. Sharda Pasricha and Pragya Gahlot write about the mechanism of enzyme inhibition with the example of the effect of copper sulphate pentahydrates on α -amylase in the article



‘How Enzyme Inhibition Works!’

In the second part of a series titled ‘Mathematical Musings on the External Anatomy of the Novel Coronavirus’, Jyotirmoy Sarkar and Mamunur Rashid show that with a mathematician’s musings, the novel coronavirus takes on attractive and intriguing shapes and symmetric beauty. K R Shivanna’s article ‘The Plight of Bees and Other Pollinators, and its Consequences on Crop Productivity’, examines the status of pollinators in the context of monocultivation, the practices of managed pollinators, and the outcomes. In the Indian context, evaluation of pollination efficacy is, at best, rudimentary. The impacts of other processes like environmental degradation, climate change, etc., also need to be studied. In the article ‘Euclidean Geometry by High-performance Solvers?’, Siddhartha Gadgil and Anand Tadipatri show that the question could be answered algorithmically. They demonstrate this with an attempt to solve a Euclidean geometry problem using state-of-the-art software. Another article mathematical article, ‘Sums of Powers of Integers and Stirling Numbers’, is by José Luis Cereceda.

While S Nath and P Mandal write on ‘Revisiting the Systematics of α -decay’, Raghunath O. Ramabhadran writes about ‘Defining the Heats of Reactions Using the Concept of Extent of Reaction’. In the spirit of the World Metrology Day, the issue also carries an article by Shanay Rab and Sanjay Yadav titled ‘Concept of Unbroken Chain of Traceability’.

A new series by Raghavendra Gadagkar: Bibliophilia begins with a biography of Evelyn Hutchinson—“the Father of Modern Ecology”. This article features not his work but his writings and, not the least, a biography written by Nancy Slack. It seeks to evaluate the impact of science writing and expression have on the reader or listener. Hutchinson’s life in science, as described by his biographers and his own writings, seems an exemplary one, where he thought, taught, and expressed fluently many ideas that later developed into the science of ecology.

The Classroom section has two features in this issue. ‘How to



EDITORIAL

Stop Collusion in Peer Review Exercises: Evidence From the Classroom' is a short examination of reciprocal rating or a two-way rating system in classrooms, which is frequently used in peer reviews of students' performances in group projects or assignments. This article shows how a modified score function can be used to identify and stop collusion between students/groups. The second feature, 'When Trolley and Skateboard Decided to Take the Stairs', examines the motion of a skateboard or trolley poised on stairs. The physics behind this problem and some of its extensions are illustrated.

A Research News item on the 2021 ACM Turing Award Winner, penned by Subodh Kumar also features in this issue.

