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Editorial: Women in science: Physics

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Editorial on the Research Topic
Women in Science: Physics

Physics is among the worst of the physical sciences in terms of representation of women in many countries [1], and representation has remained equally poor for the past 20 years, despite numerous efforts that have been made by various actors to reduce the gender gap in the field [2]. On top of this low level of representation, the recognition and visibility of women physicists' achievements is affected by implicit biases that contribute to the perpetuation of gender stereotypes and inequalities across STEM fields [3]. In this regard, the continuous evaluation that scholars in science are subjected to and the scientometric tools that are commonly used to assess performance based on publication records are not free from biases or stereotypes [4–7]. The Research Topic on "Women in Science: Physics" represents a timely platform for the promotion of the work of women scientists across all physics-related fields, in the understanding that this may increase their visibility and help to level the uneven landscape of scientific publication.

Even though the fraction of women who are co-authors of scientific papers has increased over the last 20 years [4], more detailed analyses show that the prestigious first and last author positions are usually occupied by men and that very few women publish single-authored papers [5]. Male authors, on the other hand, receive 30% more citations than women, with the largest differences occurring in the case of high-impact authors [6]. Furthermore, papers with male first and last authors under-cite, by 23.4%, papers with first and last authors who are women [6]. A recent study [7] making use of a model to predict the expected citation rate of a paper has found that papers authored by women are significantly under-cited and tha those authored by men are over-cited. Another study on publications in mathematics has demonstrated a temporally stable negative correlation between journal rank and percentage of women co-authors [8]. In relation to this finding, it is not clear whether women are less likely than men to submit their papers to top-ranked journals because of a lack of confidence or whether other factors explain the negative correlation. In any case, these results confirm that prestige attained *via* scientific publications is affected by gender bias. Prestige itself, in turn, affects visibility and citations. The study in [9] shows that single-blind reviewing gives a significant advantage to papers with famous authors or authors from prestigious institutions, revealing a self-reinforcing process that amplifies inequalities. A comparison of publication patterns in certain STEM fields [10] has shown that the proportion of women in astronomy, astrophysics, and related subjects who are authors of publications in top journals has markedly increased since 1970, along with the 10-fold increase that has occurred over that period in the number of authors. This might be an indication that more collaborative work can exert a positive impact on the publication records and careers of women scientists.

The papers published in the "Women in Science: Physics" Research Topic provide a glimpse of the diversity of areas in which women engage in research in the physical sciences. Four of them report experimental results based on neutron scattering techniques, and a fifth combines one such technique with first principles calculations to address a variety of problems of interest in biology and materials science. The Research Topic is then completed with a review on various aspects of an archetypical example of magnetic frustration and a paper on the analysis of galactic cosmic ray fluxes. In greater detail, the paper "*High Hydrostatic Pressure–A Key Element to Investigate Molecular Dynamics in Biosystems*" by Peters presents the results of applying high pressures to biological samples in order to investigate molecular dynamics using elastic incoherent neutron scattering. As mentioned by the author, the approach sheds light on conformational substates that cannot otherwise be probed and provides clarity on aspects specific to high pressure environments, such as those that were prevalent around the first living organisms on Earth. The paper "*Water in Deep Eutectic Solvents: New Insights From Inelastic Neutron Scattering Spectroscopy*", by Nolasco et al., presents the results of using inelastic neutron scattering (INS) spectroscopy to study the effect of water on the physicochemical properties of deep eutectic solvents (DES), a new class of materials that is attracting extensive attention as a set of sustainable alternatives to conventional solvents. The authors also explored the suitability of the INS technique for the pursuit of this type of research, finding that shock freezing the samples may retain the liquid phase morphology of DES at the low temperatures required by INS spectroscopy. The paper "*Nanoscale Structure and Dynamics of Model Membrane Lipid Raft Systems, Studied by Neutron Scattering Methods*" by Ahmadi et al. presents the results of using quasi-elastic and small angle neutron scattering to determine the structure and dynamics of three-component lipid membranes. These results demonstrate the sensitivity of lipid diffusion in membranes to local cholesterol concentration and show how the novel combination of techniques applied by the authors enables a non-invasive characterization of structure and dynamics in media that are as heterogenous as cell membranes. The paper "*Interactions, Diffusion, and Membrane Fluctuations in Concentrated Unilamellar Lipid Vesicle Solutions*" by Kelley et al. examines how neutron scattering experiments should be analyzed when probing the diffusion of lipid vesicles in concentrated solutions. The authors show that there are direct and indirect interactions between the vesicles that should be accounted for when fitting the observations in order to obtain reliable results, a detailed analysis of which can open up new avenues for an understanding of the interactions between lipid-based assemblies. The paper "*Lattice Dynamics in Organic Ferroelectrics Using Neutron Spectroscopy and Ab-Initio Modeling*" by Mukhopadhyay uses inelastic neutron scattering spectroscopy and first principles calculations to study certain microscopic properties of the material PhMDA, which are relevant to explain its ferroelectric behavior. Organic ferroelectrics such as PhMDA are of interest for their potential technological applications and relatively low cost. The paper "*An Overview of the Director State in Gadolinium Gallate Garnet*" by Deen presents a review of the emergent behavior of an archetypical example of magnetic frustration (GGG), which was revealed a few years ago. The review focuses on its director state, bringing together experimental results and theoretical analyses on a material currently of great interest for its unique and complex physical effects. Finally, the paper "*The Rigidity Dependence of Galactic Cosmic-Ray Fluxes and Its Connection With the Diffusion Coefficient*" by Vecchi et al. presents the results of using a realistic propagation model to analyze the data on galactic cosmic ray fluxes collected by the Alpha Magnetic Spectrometer (AMS-02). The study shows that the simplified view within which the results are usually analyzed and fit does not apply to these data and provides predictions for further analyses not yet carried out by the AMS collaboration.

The Research Topic also reflects in part the dynamics and characteristics of publication patterns among women. There are three single-authored papers, but the total number of male co-authors is slightly larger than the number of women (19 vs. 17). Most of the papers are interdisciplinary, addressing applications in biology, materials science, and astrophysics. There is not a single co-author with an affiliation to an institution based in a developing country. All efforts to make the practice of science more inclusive and diverse in terms of gender are very important; it is important to advance these efforts with actions to increase inclusion on other dimensions as well.

Author contributions

SPD conceived and wrote the editorial.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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