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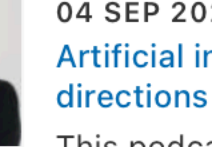
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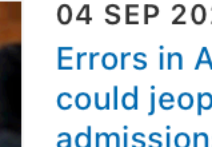
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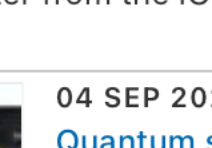
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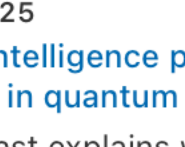


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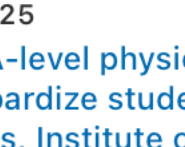


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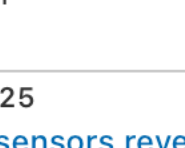
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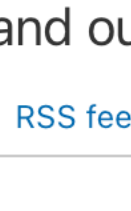
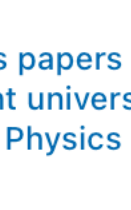
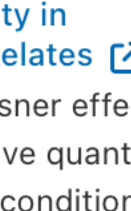

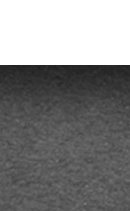
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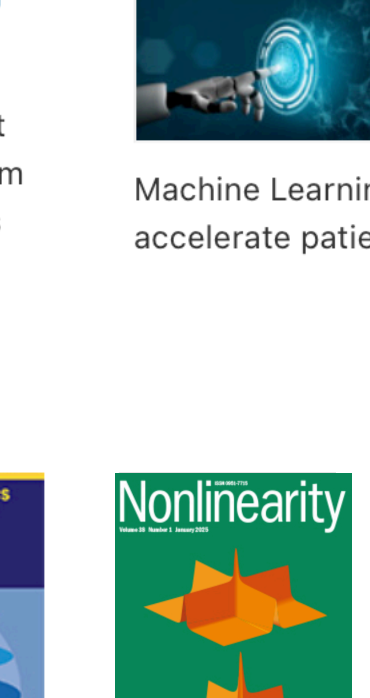
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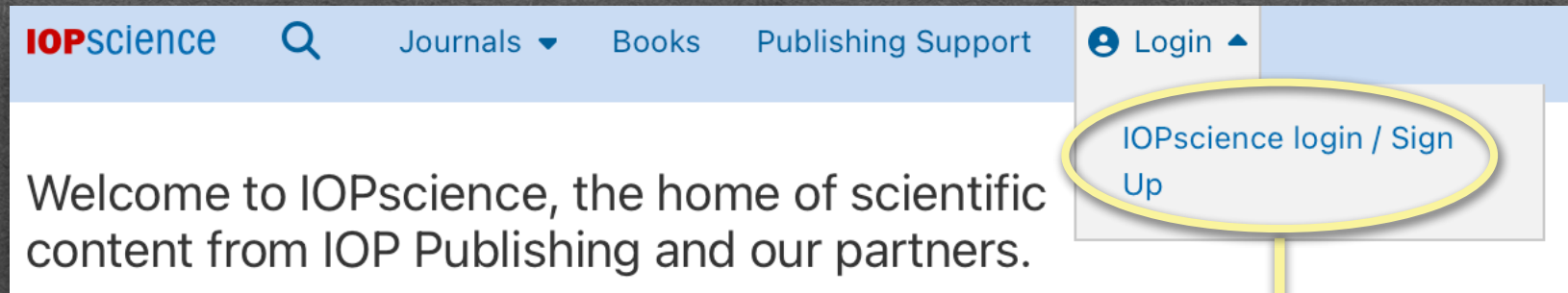
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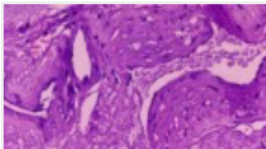
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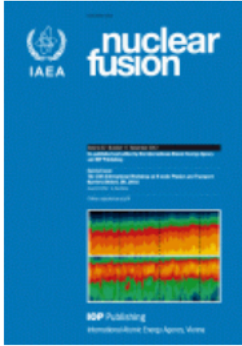
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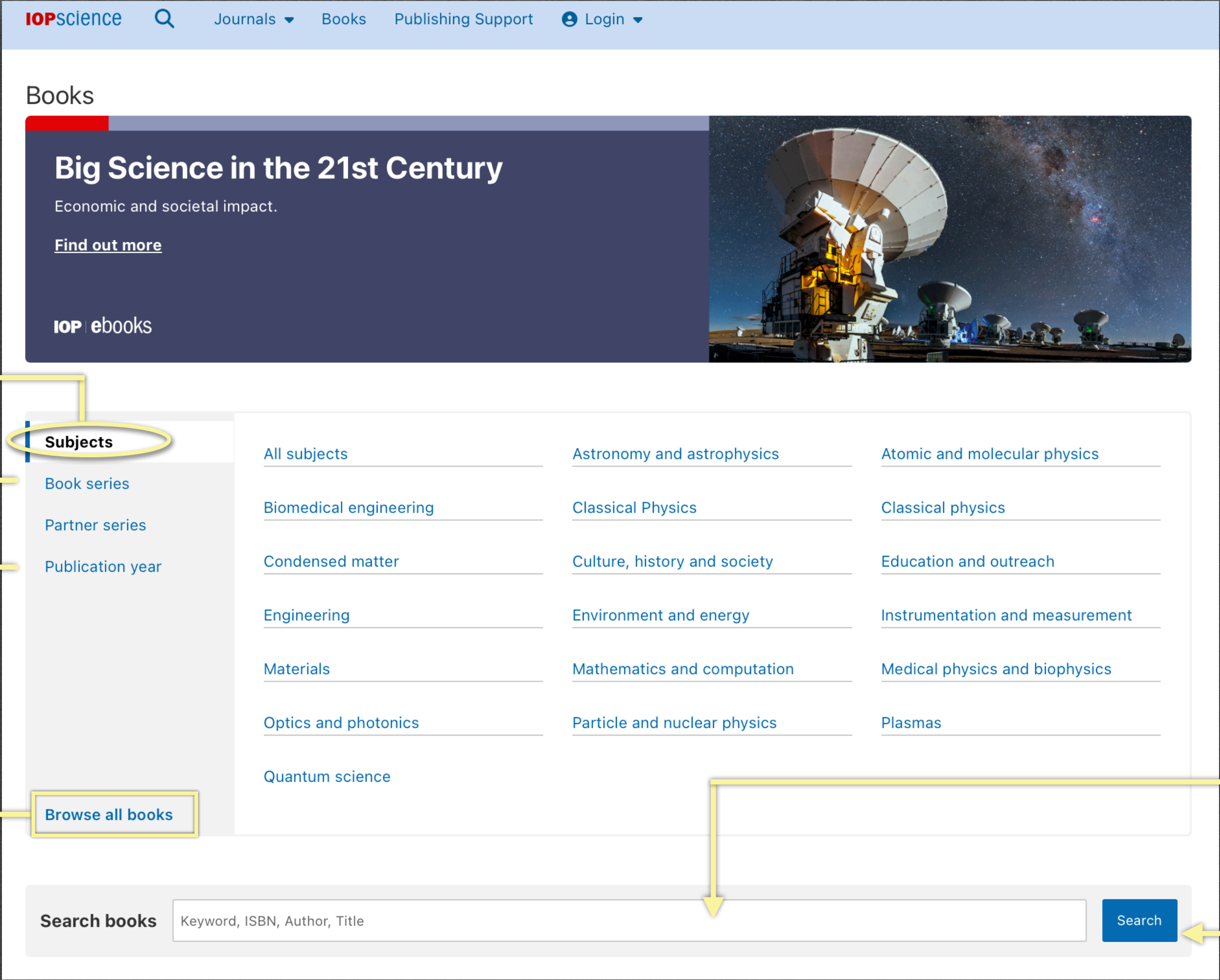
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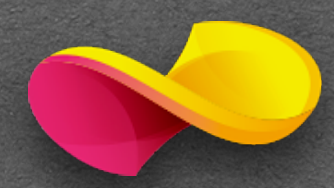
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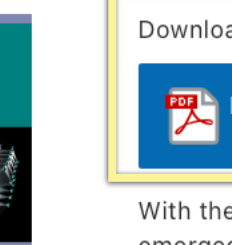
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2D Materials as Electrocatalysts



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Authors
Muhammad Ikram^{1,4}, Ali Raza^{2,4}, Jahan Zeb Hassan^{1,4} and Salamat Ali³

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With the discovery of graphene, 2D materials have emerged as some of the most promising candidates for heterogeneous electrocatalysts owing to their unique physicochemical and electronic properties. This research and reference text covers the latest advances in the area of 2D material-based electrocatalysts for electrocatalytic processes, including the key principles, pros and cons, synthesis, tuning, performance, challenges, and future opportunities. Intended for researchers and graduate students, this will be the first book on 2D materials as electrocatalysts and will enable readers to understand the mechanisms behind the electrolysis and synthesis of 2D electrocatalysts. It will also be beneficial for industry experts working with the HER, ORR, and CO₂ reduction processes for large-scale usage.

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Introduction to 2D electrocatalysts

Muhammad Ikram¹, Ali Raza², Jahan Zeb Hassan¹ and Salamat Ali³

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This chapter introduces the significance of 2D materials in electrocatalysis, focusing on their unique structural, electronic, and mechanical properties. Materials such as graphene, transition metal dichalcogenides, and MXene exhibit enhanced catalytic performance owing to their high surface area, tunable electronic properties, and active site density. This chapter explores strategies such as doping, defect engineering, and heterostructure formation to improve the catalytic efficiency for reactions such as hydrogen evolution (HER) and CO₂ reduction. It also addresses challenges, such as stability, scalability, and the need for precise synthesis methods to advance the field of 2D electrocatalysts.

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