Altmetric Analysis of Physics Publications Indexed in Dimensions (2015–2024): A Decade of Online Attention and Research Impact

Premkumar
Research Scholar,
Dept of Studies in Library & Information Science,
University of Mysore, Karnataka, India.
e-Mail: premkumarmlisc@gmail.com

M. Chandrashekara
Senior Professor,
Dept. of Studies in Library & Information Science,
University of Mysore, Karnataka, India.
e-Mail: chandra.uom@gmail.com

Abstract

This study analyses physics research published from 2015 to 2024, utilising data from Dimensions and Altmetric.com to assess publication growth, online attention, and citation impact among 535,598 publications. It has seen a steady increase in publications, especially in subfields such as quantum and nuclear physics. Although 83.8% of outputs received some online attention, only a few had high Altmetric Attention Scores (AAS), indicating unequal visibility. Notably, prominent journals such as Nature and Science garnered significant media attention, with Twitter being the leading platform for online engagement. Correlation analysis revealed a weak association between citations and AAS, suggesting online visibility does not equate to scholarly impact. The findings emphasise the importance of altmetrics for public engagement and the dissemination of physics research alongside traditional citation metrics.

Keywords
Physics research; Altmetric Attention Score; Dimensions database; Online attention
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1. Introduction

Research in physics over the last decade has undergone a substantial revolution, characterised by interdisciplinary approaches, technological innovations, and enhanced digital engagement. The decade witnessed notable developments in physics field, mainly in areas like online learning and medical physics (Suprapto et al., 2024). Trends in research disclosed dramatic rises in publication volumes, particularly during challenging periods like the COVID-19 pandemic (Suprapto et al., 2024). Digital platforms and e-learning transformed physics education, globally accessible, technology-integrated, and enabling greater research adaptability (Prahani et al., 2022). The primary signs of growth are: Increased focus on 21st-century skills, expanding interdisciplinary collaborations, and learner-centred and more interactive research approaches (Hidayatullah et al., 2021). The research landscape reveals a clear shift towards more technologically mediated and dynamic scientific exploration.

1.1. Limitations of Traditional Citation-Based Metrics

Traditional metrics like citations are important for measuring research impact and quality, fails in capturing the research visibility and societal engagement. Altmetrics offer alternative ways of evaluating research influence and enable assessment of societal impact of research almost in real time, whereas citation-based metrics take much time (Baheti & Bhargava, 2017). The revolution in digital and social media has brought significant changes in sharing the scientific information and how it influences the society. Citations-based metrics fail to capture wider social engagement and it is important to measure the social impact of scholarly output (Baheti & Bhargava, 2017). There is a limited representation of audience in citation metrics, which overlooks the growing integration of blogs, Mendeley, Twitter, and other social media into scholarly communication (Patthi, 2017). This ignores the important research engagement occurring in other digital platforms.

Bibliometric analysis of the physics education research, revealed that highly variable citation patterns that may not reflect actual visibility or utility of research (Zain & Samsudin, 2015). Publication volume in medical physics research, especially during COVID-19, witnessed dramatic increases, but traditional citation metrics did not capture the immediate impact on society and its practical applications (Suprapto et al., 2024). Publication trends and citation patterns of nuclear physics research show that societal impact doesn't necessarily correlate with citation increases (Ramiah, 2016). These limitations underscore the need for complete approaches that combine alternative metrics and traditional metrics to completely capture research visibility and its impact.

1.2. Emergence and Importance of Altmetrics

The emergence of alternative metrics reflects broader transformations in how research is conducted, disseminated, and evaluated in the digital era. The recent decade has witnessed significant changes in the distribution of physics research, with revolutions occurring across the field (Durrani, 2019). This digital evolution has created new avenues for scholarly visibility beyond traditional academic networks. The integration of digital tools in physics education reveals the increasing importance of alternative metrics. Hidayatullah et al. (2021) opined that critical thinking, collaboration, communication, creativity, innovation, and problem-solving skills have turned out to be essential skills in physics education. These skills directly translate to new forms of research communication and impact measurement. Research visibility patterns has changed fundamentally by the shift toward digital platforms. Flexibility of digital platforms make learning more efficient with deepen understanding of concepts (Prahani et al., 2022). This also applies to research distribution, where altmetrics capture visibility and mentions across various digital and social platforms.

Recent analysis by Hapsari and Mundilarto (2024) shows that online education in physics has become engaging, student-centric, and interactive, resulting in better understanding of the content. This change aligns with how alternative metrics capture communication engagement with scholarly content across various digital channels, including blogs and social media. This digital transformation has made research more accessible in physics, with significant changes to physics education delivery occurring through digital platforms. Alternative metrics are important since they capture this worldwide engagement that citation metrics miss. The context of the digital and social media revolution explains why altmetrics have become crucial - they analyse the new forms of scholarly engagement and their impact that have emerged alongside the digitisation of scholarly communication.

1.3. Importance of Altmetrics in Physics

The increasing adoption of altmetrics is closely tied to broader shifts in how physics research is conducted, published, and evaluated in a digitally networked age.

- The Change to Online Learning: Research indicates that online learning enables the flexibility of the learning process, teaches students to be independent, practices technology, deepens students’ understanding of concepts, and makes the learning system more efficient (Prahani et al., 2022). And it’s the same for research exposure via alternative metrics, which track engagement across different online channels.
- Interactivity of research communication: Interactive participation is at the heart of successful online physics learning: online physics learning activities are “more interactive, engaged, and learner-centered in nature to acquire a better conceptual understanding (Hapsari & Mundilarto, 2024). Like Altmetrics, which track readers' engagement with scholarly literature on social media sites, blogs, and other internet platforms.
- Global accessibility - the physics inquiry is accessed more globally as a result of the digital revolution, and it has still brought a significant impact to the mode of delivery during the physics education process that can be achieved through both media (Hapsari & Mundilarto, 2024). Altmetrics are a significant development because they capture the extended universe of global engagement that citation metrics often overlook.
- The situation of digital transformation – Altmetrics demonstrates its essential nature, as it measures the new ways of doing impact and engagement-related research caused by the digitization of scientific communication.

2. Research Questions

RQ1: What are the trends in publications on physics research from 2015 to 2024 in the Dimensions database?

RQ2: What has been the level of online attention to physics publications, in terms of Altmetric Attention Score and platform-specific attention scores?
RQ3: What are the relative contributions from various online platforms to the online attention of physics publications between 2015 and 2024?
RQ4: How is online attention (the Altmetric Attention Score) associated with scholarly impact (citations) of physics articles?

3. Review of Literature

The advent of alternative metrics (Altmetrics) has transformed the assessment of scholarly impact by increasing the resources beyond citation measures. Priem et al. (2011) pointed out to the Altmetrics Manifesto, which claimed that there is a need for non-traditional indicators measuring immediate online mentions with research output. Bornmann (2014) noted that the altmetrics are an indicator of social visibility beyond academia, including media attention, public engagement, and social dissemination. Haustein (2016) describes altmetrics as multi-sourced, reflecting their collection from a wide range of online sources, including platforms such as blogs, news sources, and Mendeley. Finally, together these studies advance influential case for altmetrics as a complementary indicator to citation-based metrics.

3.1. Altmetrics vs. Traditional Citation Metrics

Several scholars have compared conventional citation with altmetrics analysis. Costas et al. (2015) Investigated relationships between altmetrics and citations in different subject areas and concluded that Facebook and X(Twitter) postings were weekly correlated, while citations were moderately correlated with Mendeley readership. It was further noted that altmetric data is an immediate online attention indicator, whereas citations serve as a lagging indicator (Sugimoto et al. (2017). Haustein et al. (2016) Suggested that altmetrics indicate different aspects of impact (academic influence vs public visibility). These results support the idea that altmetrics are not projected to replace citations but as an alternative which offer a multifaceted and broad view of impact dimensions.

3.2. Altmetric Studies in Scientific Disciplines

Altmetric analyses have been widely carried out in biomedical sciences, social sciences, and COVID-19 research, but fewer studies have centred on physics. Research data was analyzed by Peters et al. (2016) and concluded that altmetrics highlight both public and scholarly engagement. Although there have been a few studies examining altmetrics in physics or similar subjects, Thelwall (2016) studied citations in physics subject and noted that public attention is often triggered by main discoveries such as quantum computing, particle physics, and gravitational waves findings. But, systematic altmetric analyses of physics publications still remaining, indicating a clear gap in the literature.

3.3. Dimensions Database in Research Evaluation

Dimensions has become a well-known platform for its comprehensive research analytics, which combines publications, funding data, Altmetric attention scores, citations, and more. Hook et al. (2018) provided evidence that the Dimension database is advanced in research assessment as it integrates publications, citations, and their online attention metrics. Additionally, Herzog et al. (2020) note that the Dimension database offers comprehensive coverage, clearer metadata, and direct integration with altmetric attention scores. Since Dimension database offers real-time online visibility and wide-ranging metadata at the article level, many researchers suggest its adoption in altmetric research across fields due to its rich data collections.

3.4. Identified Research Gaps

Although altmetrics have been covered by a plethora of studies across several scientific disciplines, it has come to our attention that no focused research occurs evaluating the online visibility of physics research. Most earlier researchers focus on general Science, Technology, Engineering, and Mathematics (STEM) areas and do not study trends specific to physics research. Additionally, prior studies rarely combine subfield-specific analyses (e.g., condensed matter physics, particle physics, quantum physics) with altmetric indicators. The integration of subject classification, citation, and altmetric data is available through the Dimension database but has been sparsely utilized for physics-based altmetric analysis. Hence, there is a lack of research on how physics research has been carried out, debated, and consumed online over the last decade. The present study fills this gap by focusing solely on physics articles indexed in Dimensions during the period 2015–2024 using an altmetric analysis.

4. Methodology

The research design of this study is descriptive, quantitative, and analytical, examining the trends in publications. Analysed the scholarly impact of physics research published between 2015 and 2024 and its online visibility. All bibliographic and citation data were collected from the Dimensions database, and altmetric data were collected from Altmetric.com. Dimensions is a comprehensive research analytical tool that combines publications, altmetric data, citations, funders, and field-based classifications. Unlike Scopus or Web of Science. Altmetric.com provides Altmetric Attention Scores and detailed online engagement metrics across various media channels, including news outlets, Blogs, Facebook, Instagram, Policy documents, and academic reference management platforms like Mendeley. The Dimensions provide information about publications (metadata & citations), supplemented with attention indicators online, collected by Altmetric.com. Additionally, Physics research was selected by the FOR method of classification. The following subject category codes were used:

- 5102 (Atomic, molecular, and optical physics),
- 5103 (Classical physics),
- 5104 (Condensed matter physics),
- 5105 (Medical and biological physics),
- 5106 (Nuclear and plasma physics),
- 5107 (Particle high energy nuclear), and
- 5108 (Quantum Physics).

Study included only journal articles from 2015 to 2014, and conference papers, book chapters, and non-English publications are excluded. The downloaded data set comprised the titles of publications, names of journals, DOIs, publication years, and FOR category indicators. There were also Altmetric Attention Score (AAS) and platform-specific attention metrics for X/Twitter mentions, blog posts, news mentions, Wikipedia citations Facebook mentions, Reddit posts, and other metrics, along with citation counts from Dimensions. After downloading the data, Microsoft Excel was used to remove duplicates, unrelated entries, and incomplete entries. Study employed descriptive statistics to assess trends in publication, distribution of AAS, and platform-specific online attention. To measure the association between scholarly impact, online attention, performed a Spearman test on citation counts and AAS of the top 100 most visible publications using SPSS. Data were organized in tables with explanations. No ethical issues were raised, as the study was based solely on publicly available secondary data.

5. Data Analysis and Interpretation

5.1. Publication Trend of Physics Research (2015–2024)

5.1.1. Year-wise Distribution of Publications and Citations

Table 1. Year-wise Physics Publications and Citations (2015–2024)

Year	Number of Publications	Citations Received
2024	1,86,573	32,99,744
2023	1,82,486	28,60,748
2022	1,77,781	25,97,951
2021	1,72,198	22,63,461
2020	1,69,745	18,27,907
2019	1,66,295	14,03,166
2018	1,58,336	10,53,038
2017	1,65,781	7,17,389
2016	1,73,907	3,96,305
2015	1,66,116	91,626

From the year-wise distribution, it is evident that research output in physics maintained a steady upward trend throughout the decade, with the number of publications growing from 1.58 lakh to 1.86 lakh articles per year. The peak number of publications occurred in 2024 (1,86,573 articles), closely followed by 2023 and 2022. This suggests a continued increase in physics research, notably in the post-COVID-19 era (2021–2024). A slight drop in articles is noticeable in 2018, but it immediately recovers to below the reference score. The citation history complies with the empirical trend of an increase in citations for earlier publications and a decrease in the number of citations for later records, as the publications from 2015–2017, on the other hand, have a low publication count but a high citation-generating capacity, especially that of 2015 (92K), with a steadily rising trend observed each year. The maximum number of citations is for 2024 (32,999,744 citations), demonstrating the growth in the size and influence of physics research in recent years. Overall, the data suggest a clear and steady increase in both physics research output and its impact over the upcoming decade, from 2015 through 2024. The increasing trend in publications indicates a stable worldwide interest in physics research, while the upward pattern in citations reflects the substantial academic impact of this area (Table 1 & Figure 1).

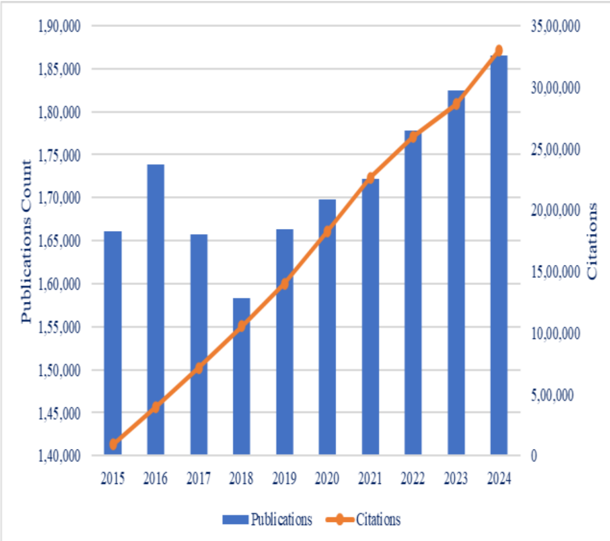

Figure 1. Year-wise Physics Publications and Citations (2015–2024)

5.1.2. Subfield-wise Distribution of Publications

Table 2. Subfield-wise Physics Publications (FOR Codes).

FOR Code	Subfield	Publications
5102	Atomic, Molecular, and Optical Physics	3,23,903
5103	Classical Physics	1,72,325
5104	Condensed Matter Physics	4,06,581
5105	Medical and Biological Physics	96,401
5106	Nuclear and Plasma Physics	4,02,424
5107	Particle and High Energy Physics	3,22,959
5108	Quantum Physics	3,69,618

From the subfield-wise distribution, it emerges that Condensed Matter Physics (5104) is the most productive, with 4,06,581 publications, which are preferred at a universal level in the field of physics research. This is then followed by Nuclear and Plasma Physics (5106), with 4,02,424 papers, and Quantum Physics (5108), with 3,69,618, as the fields that received considerable research attention in new quantum technologies and the energy-related physics sector. Other subfields, including Particle and High Energy Physics (5107) and Atomic, Molecular, and Optical Physics (5102), also exhibit high research output, yielding more than 3.2 lakh publications each. Classical Physics (5103) also shows the lowest output (1,72,325 publications), which is not surprising because it focuses on the foundational and theoretical aspects of research. The least productive line of research is in medical and biological physics (5105), with 96,401 publications, which concerns a more specific subfield of Physics. In general, the subfield analysis indicates that among the 68 physics subfields, Condensed Matter Physics, Nuclear and Plasma Physics, and Quantum Physics are producing the most publications in Dimensions' physics output, possibly drawing from strong global research in materials/advanced quantum technologies, as well as energy/plasma.

5.2. Online Attention Received by Physics Publications

5.2.1. Altmetric Attention Score (AAS) Distribution

Table 3. Altmetric Attention Score (AAS) Distribution

Metric	Value
Minimum AAS	0
Maximum AAS	9,968
Total Publications	5,35,598
Publications with AAS = 0	86,749
Publications with AAS > 0	4,48,858

The Altmetric Attention Score distribution ranges from 0 to 9968, representing that while most physics papers have very little or no online authorship, a small fraction achieve very high visibility. Of the 5.36 lakh publications, around 16% did not attract any interest online at all, while 84% received at least some attention on the Internet. These results suggest that physics research is highly represented on digital media, although its online attention differs in terms of the number of articles.

5.2.2. Publications With and Without Online Attention

Table 4. Publications With AAS = 0 vs AAS > 0

Category	Count	Percentage
AAS = 0 (No Online Attention)	86,749	16.2%
AAS > 0 (Online Visibility)	4,48,858	83.8%
Total	5,35,598	100%

Most (83.8%) of the physics publications had received online attention in some form. The lowest number of charts on digital platforms that went unnoticed was 16.2%. Therefore, the results demonstrate that physics research is widely followed by both the public and the academic sector, but to different extents depending on where it is published.

5.2.3. Top 10 Publications by Altmetric Attention Score (AAS)

The online visibility of the top 10 physics journals, with AAS values ranging from 3,105 to 9,968, was exceptionally high. Many of the most obvious articles were published in journals with high impact factors, such as Nature, Science, and Nature Astronomy, indicating that they were relevant to a wide range of scientific fields. The flagship paper about phosphine in the Venusian atmosphere went viral for its hint of alien life. Most papers were also driven by news media and X (Twitter).

Table 5. Top 10 Most Visible Physics Publications (Based on AAS)

Rank	Title	Year	Journal	DOI	AAS	X (Twitter)	News	Blogs	Facebook	Wikipedia
1	Phosphine gas in the cloud decks of Venus	2020	Nature Astronomy	10.1038/s41550-020-1174-4	**9968**	6122	1369	129	26	59
2	Quantum supremacy using a programmable superconducting processor	2019	Nature	10.1038/s41586-019-1666-5	**6928**	4752	890	120	19	73
3	Radar evidence of an accessible cave conduit on the Moon	2024	Nature Astronomy	10.1038/s41550-024-02302-y	**4692**	1388	734	20	6	10
4	Assessing the size and uncertainty of remaining carbon budgets	2023	Nature Climate Change	10.1038/s41558-023-01848-5	**4145**	1041	541	31	2	5
5	Test of lepton universality in beauty-quark decays	2022	Nature Physics	10.1038/s41567-021-01478-8	**3712**	802	430	25	4	4
6	Gravitational lensing by spinning black holes… Interstellar	2015	Classical & Quantum Gravity	10.1088/0264-9381/32/6/065001	**3510**	16854	45	22	128	18
7	A smooth exit from eternal inflation?	2018	JHEP	10.1007/jhep04(2018)147	**3470**	1930	431	41	32	17
8	*RETRACTED*: Room-temperature superconductivity…	2020	Nature	10.1038/s41586-020-2801-z	**3150**	3335	222	47	8	23
9	Achieving optical transparency in live animals	2024	Science	10.1126/science.adm6869	**3137**	1952	336	31	3	5
10	The evolution of galaxy number density at z < 8	2016	The Astrophysical Journal	10.3847/0004-637x/830/2/83	**3105**	5557	281	27	11	38

5.3 Platform-Specific Online Attention (2015–2024)

Table 6. Platform-wise Total Online Attention

Platform	Total Mentions
X (Twitter)	**20,37,728**
News	2,53,640
Blogs	70,113

Facebook	64,490
Patent Mentions	57,884
Wikipedia	33,784
Google+	16,251
Q&A Sites	12,961
Reddit	11,751
Bluesky	10,089
Policy Documents	2,114
Podcasts	1,612
Clinical Guidelines	826
Weibo	313
F1000	86
LinkedIn	0
Pinterest	0

Online dominance was equally enjoyed by X (Twitter), with more than 20 lakh mentions, which represented that many online discussions related to physics. News outlets contributed significantly (2.5 lakh mentions), indicating high media attention for these significant physics discoveries. Blogs, business, Facebook, and Wikipedia contributed to low engagement, but policy. Documents, F1000, and clinical guidelines (Figure 5) had low activity. The presence of mentions on Bluesky and Reddit demonstrates new and community-led interest in physics research.

5.3.1 Major Sources of Online Attention

Based on Figure 2, X (Twitter) is the strongest source of online attention. The news suggests that social media and media attention play a significant role in shaping the visibility of physics research. Other platforms, such as blogs, Facebook, Wikipedia, and Reddit, provided modest but discernible participation. In contrast, policy documents, Q&A websites, F1000, and clinical guidelines were the least represented, with sources such as policy documents, Q&A sites, F1000, and clinical guidelines having a minimal presence. Taken together, the pattern shows that social media and news media lead the online presence of physics journals, while other platforms may be contributing in comparatively small proportions of attention.

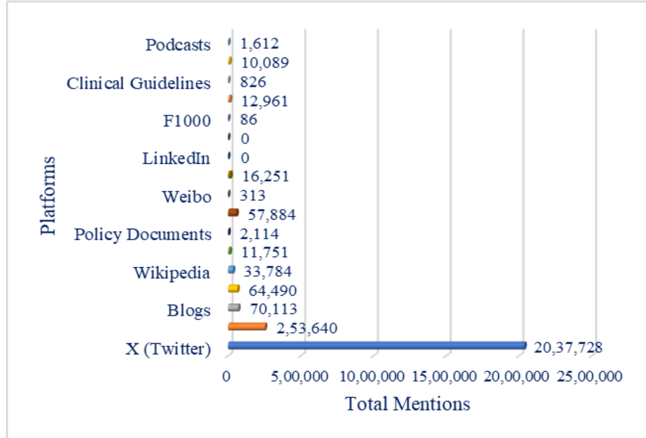

Figure 2. Primary Sources of Online Attention

5.4 Relationship Between Online Attention and Scholarly Impact

5.4.1 Correlation Between Altmetric Attention Score (AAS) and Citations

Table 7. Correlation Between AAS and Citations (Spearman's rho)

Correlations

			AAS	Citations
Spearman's rho	AAS	Correlation Coefficient	1.000	.125
		Sig. (2-tailed)	.	.217
		N	100	100
	Citations	Correlation Coefficient	.125	1.000
		Sig. (2-tailed)	.217	.
		N	100	100

The Spearman correlation suggests a weak positive association between Altmetric Attention Score and citations ($r = 0.125$, $p = 0.217$). As the p-value is greater than 0.05, there is no statistical significance, and higher online visibility does not imply higher scholarly citation in the top 100 most visible physics publications. This means that Altmetrics and citations measure different aspects of impact; online attention does not necessarily lead to an academic citation in the present dataset.

6. Findings and Discussion

The significant findings obtained from analysing publication trends, online attention patterns, platform-wise engagement between two sources (bibliographic databases and social media), and the association between online visibility and scholarly impact are discussed in this section. The findings are analysed in the light of the available literature and the broader context of physics research communication.

6.1 Publication Trends (2015–2024)

6.2 The study indicates that annual physics research output has remained consistently high over the past decade, with approximately 158,000 to 186,000 articles published each year. Productivity reached its peak in 2024, reflecting a steady and cumulative global increase in research activity.

6.3 Online Attention and Altmetric Visibility

The AAS metric studies the use of physics journals in online distribution. With a minimum of 0 and a maximum of 9,968 AAS, we observe that many articles in our corpus are interlinked, with a minimum AAS estimate, indicating maximum online interest. Roughly 83.8 per cent of the documents received some online attention, suggesting that physics research in general is more engaging to media, social, and news outlets than other scientific disciplines (excluding mathematics). On the other hand, there were very few papers that produced tens of genuinely visible ones.

The 10 strongest AAS papers were essentially big news hits in the highest-profile journals, reading (I'll provide the examples) something like Nature, Science, Nature Astronomy, Astrophysical Journal, among others. These publications were widely shared on X (formerly Twitter), as well as on news services, blogs, and Wikipedia. Popular subjects, including quantum supremacy, astronomical discoveries, planetary science, black hole modelling, and climate-related physics, captured the public's interest. The fact that a retracted paper was included in highly engaged articles suggests that research may still receive considerable attention online even after being retracted.

6.4 Major Sources of Online Attention

Across the various platforms examined, X (Twitter) accounted for an unevenly high proportion of online interest, emerging as the most frequently mentioned account across all platforms, with more than 2 million mentions, surpassing the sum of mentions from all remaining platforms.

7. Conclusion

The current study examines journal movements in physics by analysing Altmetric attention, platform-specific commitment, and citation data from 2015 to 2024. The findings reveal a substantial and ongoing research output, particularly in condensed matter, nuclear, and plasma physics, as well as quantum mechanics. While Altmetric analysis revealed that most publications produced some level of online conversation, only a small subset received remarkably close public attention, driven primarily by action on X (Twitter) and coverage in news media. Likewise, the modest and statistically non-significant relationship between Altmetric Attention Scores (AAS) and citation counts suggests that online attention does not indeed correspond to scholarly impact. This highlights the feature between Altmetrics and traditional citations. Generally, the results suggest that Altmetrics should be used in conjunction with, rather than as a replacement for, citation-based measures. Developing science communication via credible media outlets and accountable use of social platforms may help advance the visibility and public engagement of physics research.

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