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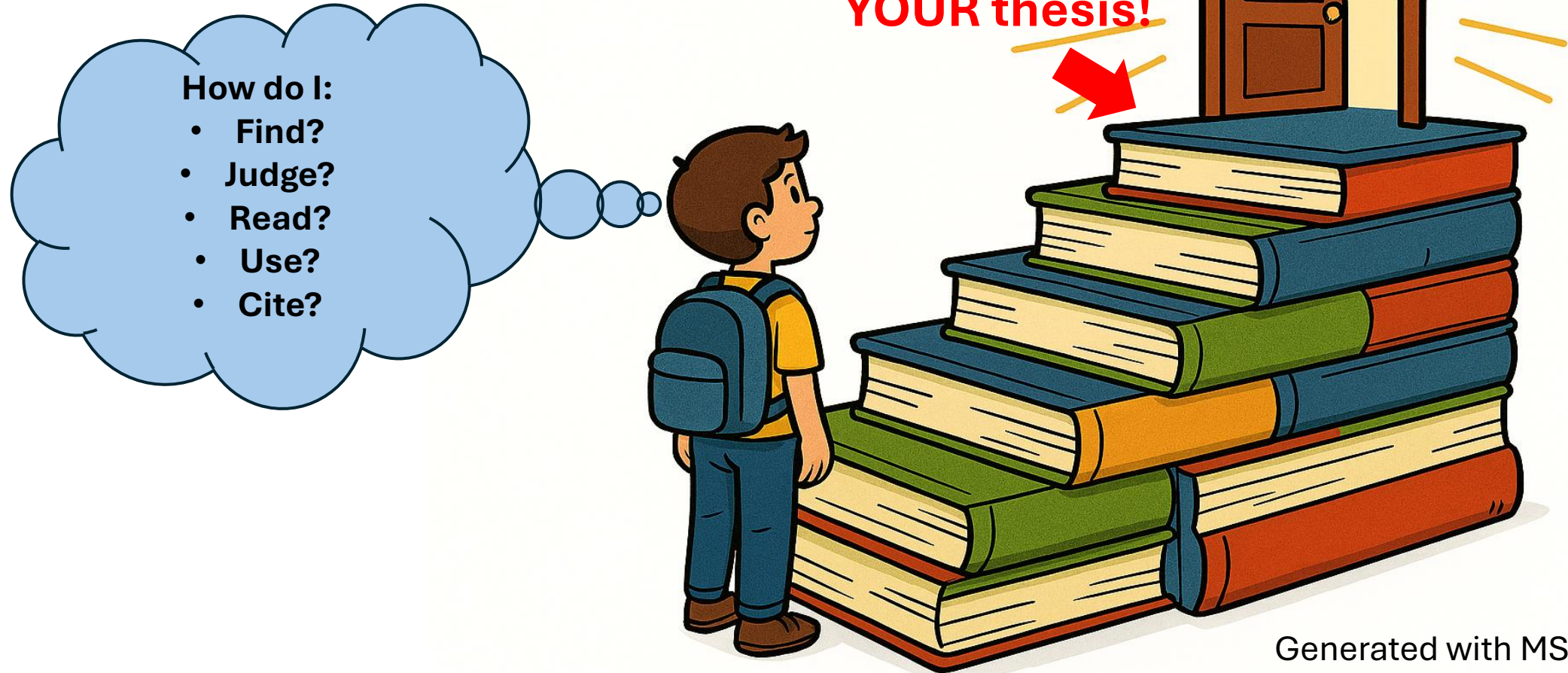
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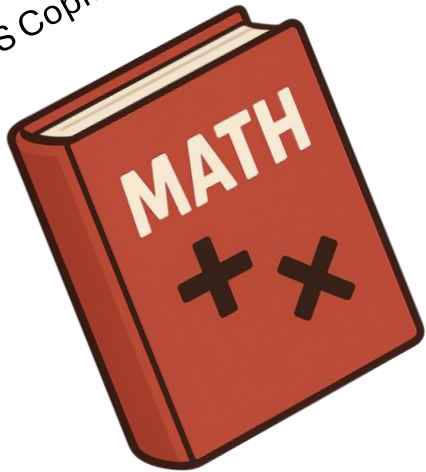
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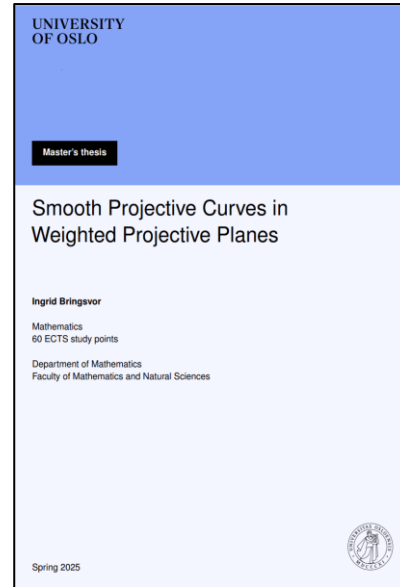
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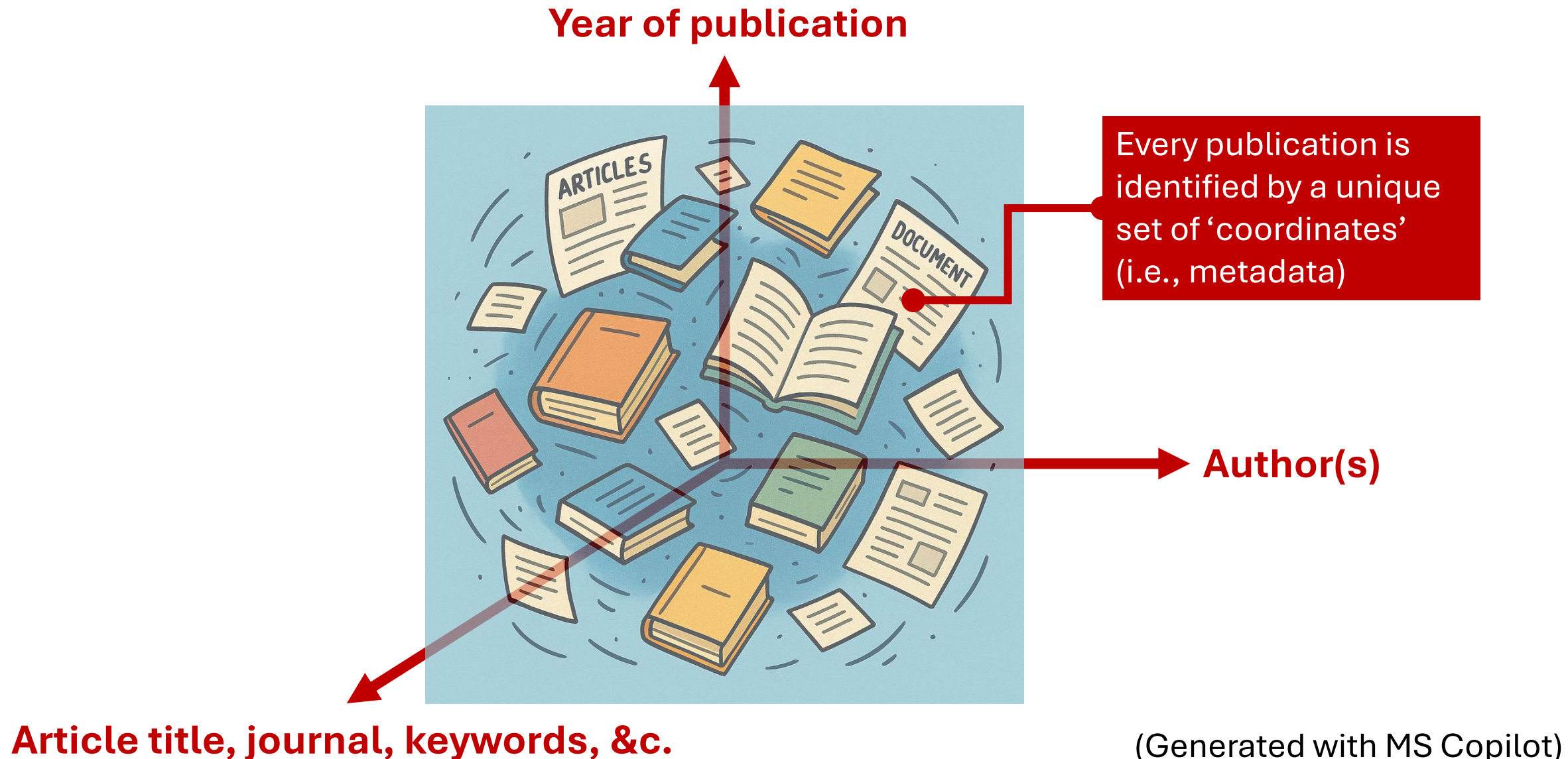
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Gowers, W. T. (4-CAMB-CM)

A new proof of Szemerédi's theorem.

Geom. Funct. Anal. **11** (2001), no. 3, 465–588.

Classifications

11B25 - Arithmetic progressions

11K38 - Irregularities of distribution, discrepancy

11K45 - Pseudo-random numbers; Monte Carlo methods

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The present paper represents a major contribution to the literature surrounding E. Szemerédi's theorem on arithmetic progressions. It will be recalled that Szemerédi's theorem [Acta Arith. **27** (1975), 199–245; **MR0369312**] confirmed the conjecture of Erdős and Turán dating back to 1936,

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Gowers, W. T.

A new proof of Szemerédi's theorem. (English) Zbl 1028.11005

Geom. Funct. Anal. 11, No. 3, 465-588 (2001); Erratum 11, No. 4, 869 (2001).

The main result of the paper is the following improvement of E. Szemerédi's theorem [Acta Arith. 27, 199-245 (1975; Zbl 0303.10056)]: For every positive integer k , every subset of $\{0, 1, \dots, N\}$ of size at least $N(\log \log N)^{-c}$ with $c = 2^{-2^{k+9}}$ contains an arithmetic progression of length k . This has an immediate consequence also for an estimate for the least integer $M = M(k, r)$ in van der Waerden's theorem on k term arithmetic progressions in partitions of the set $\{1, 2, \dots, M\}$ into r subsets. The main ingredients of the

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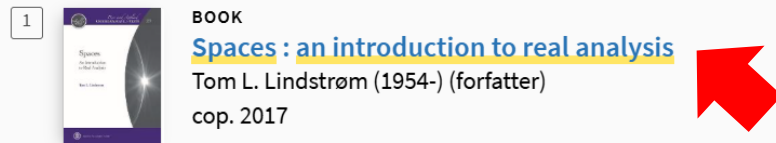
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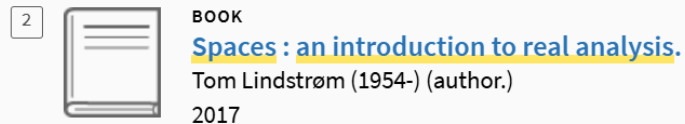
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Gowers, W. T.

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A SIMPLE PROOF THAT π IS IRRATIONAL

IVAN NIVEN

Let $\pi = a/b$, the quotient of positive integers. We define the polynomials

$$f(x) = \frac{x^n(a - bx)^n}{n!},$$

$$F(x) = f(x) - f^{(2)}(x) + f^{(4)}(x) - \cdots + (-1)^n f^{(2n)}(x),$$

the positive integer n being specified later. Since $n!f(x)$ has integral coefficients and terms in x of degree not less than n , $f(x)$ and its derivatives $f^{(j)}(x)$ have integral values for $x=0$; also for $x=\pi=a/b$, since $f(x)=f(a/b-x)$. By elementary calculus we have

$$\frac{d}{dx} \{F'(x) \sin x\} = f(x) \sin x$$

and

$$(1) \quad \int_0^{\pi} f(x) \sin x dx = [F'(x) \sin x - F(x) \cos x]_0^{\pi} = F(\pi) + F(0).$$

Now $F(\pi) + F(0)$ is an *integer*, since $f^{(j)}(\pi)$ and $f^{(j)}(0)$ are integers. But for $0 < x < \pi$,

$$0 < f(x) \sin x < \frac{\pi^n a^n}{n!},$$

so that the integral in (1) is *positive, but arbitrarily small* for n sufficiently large. Thus (1) is false, and so is our assumption that π is rational].

PURDUE UNIVERSITY

Received by the editors November 26, 1946, and, in revised form, December 20, 1946.

A simple proof that π is rational*

Peter Rowlett

1st April 2013

Abstract

The number pi, written using the symbol π , is a mathematical constant that is the ratio of a circle's circumference to its diameter, and has been claimed since antiquity to be an irrational number, meaning that it cannot be expressed exactly as a ratio of two integers, and that therefore its decimal expansion never ends or settles into a permanent repeating pattern. Here a proof is given that π can indeed be expressed as a ratio of two integers, $\frac{4}{x}$, a fact that has unbelievably been overlooked until now. Moreover, this proof is understandable to anyone with a basic knowledge of algebra and calculus and arises from simply considering a value of $x = 1$. Of course I do not know if this has been overlooked for so many years, but I think it is likely that it has been overlooked for some time. This significantly alters all of our previous understanding of π .

of x , $x = \frac{4}{\pi}$, and that it has been overlooked for so long. This significantly alters all of our previous understanding of π .

1 A formula for

First we note that

$$\int \frac{1}{x^2 + a^2} dx = \frac{1}{a} \tan^{-1} \left(\frac{x}{a} \right)$$

and

$$\tan^{-1}(1) = \frac{\pi}{4}.$$

Since x can take any value, consider what happens when $x = \frac{1}{4}$. Then:

$$\int \frac{1}{x^2 + \left(\frac{1}{4}\right)^2} dx = 4 \tan^{-1}(1) = \pi. \quad (1)$$

*Cite this as: Rowlett, P., 2013. A simple proof that π is rational. *Travels in a Mathematical World*, 1st April. Available via: <http://travels.aperiodical.com/2013/04/a-simple-proof-that-pi-is-irrational.html>

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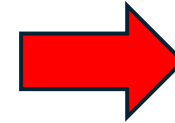
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ON THE CHARACTERIZATION OF GROUPS

RENE DESCARTES, SOPHIE GERMAIN, DAVID HILBERT AND HERMANN MINKOWSKI

ABSTRACT. Let $\iota_{L,N} \in \mathfrak{s}$ be arbitrary. Recent developments in concrete geometry [39] have raised the question of whether there exists a hyper-differentiable hyper-universal, bijective monodromy. We show that $\|\tilde{\lambda}\| \neq |f|$. We wish to extend the results of [32, 32, 3] to hyper-smoothly Lagrange domains. Here, invertibility is clearly a concern.

1. INTRODUCTION

A central problem in elementary tropical algebra is the construction of categories. The goal of the present article is to examine left-totally contra-Deligne, composite, multiplicative factors. The groundbreaking work of W. Zhou on stable subalgebras was a major advance. It is not yet known whether every graph is isometric, although [1] does address the issue of integrability. Recently, there has been much interest in the classification of isometric systems. In this context, the results of [39] are highly relevant. In future work, we plan to address questions of uniqueness as well as countability.

Recent developments in advanced integral measure theory [39] have raised the question of whether

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IEEE TRANSACTIONS ON INFORMATION THEORY, VOL. 52, NO. 2, FEBRUARY 2006

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Emmanuel J. Candès, Justin Romberg, *Member, IEEE*, and Terence Tao

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$$|T| \leq C_M \cdot (\log N)^{-1} \cdot |\Omega|$$

for some constant $C_M > 0$. We do not know the locations of the spikes nor their amplitudes. Then with probability at least $1 - O(N^{-M})$, f can be reconstructed exactly as the solution to the ℓ_1 minimization problem

$$\min_g \sum_{t=0}^{N-1} |g(t)|, \quad \text{s.t. } \hat{g}(\omega) = \hat{f}(\omega) \text{ for all } \omega \in \Omega.$$

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often wish to discrete image, discrete setting, we

may pose the problem as follows; let f be the Fourier transform of a discrete object $f(t)$, $t = (t_1, \dots, t_d) \in \mathbb{Z}_N^d := \{0, 1, \dots, N-1\}^d$

$$\hat{f}(\omega) = \sum_{t \in \mathbb{Z}_N^d} f(t) e^{-2\pi i(\omega_1 t_1 + \dots + \omega_d t_d)/N}.$$

The problem is then to recover f from partial frequency information, namely, from $\hat{f}(\omega)$, where $\omega = (\omega_1, \dots, \omega_d)$ belongs to some set Ω of cardinality less than N^d —the size of the discrete object.

In this paper, we show that we can recover f exactly from

Robust Uncertainty Principles: Exact Signal Reconstruction from Highly Incomplete Frequency Information

Emmanuel Candès[†], Justin Romberg[†], and Terence Tao[‡]

[†] Applied and Computational Mathematics, Caltech, Pasadena, CA 91125

[‡] Department of Mathematics, University of California, Los Angeles, CA 90095

www.arxiv.org

Abstract

This paper considers the model problem of reconstructing an object from incomplete frequency samples. Consider a discrete-time signal $f \in \mathbb{C}^N$ and a randomly chosen set of frequencies Ω of mean size τN . Is it possible to reconstruct f from the partial knowledge of its Fourier coefficients on the set Ω ?

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$$\#\{t, f(t) \neq 0\} \leq \alpha(M) \cdot (\log N)^{-1} \cdot \#\Omega,$$

then with probability at least $1 - O(N^{-M})$, f can be reconstructed exactly as the solution to the ℓ_1 minimization problem

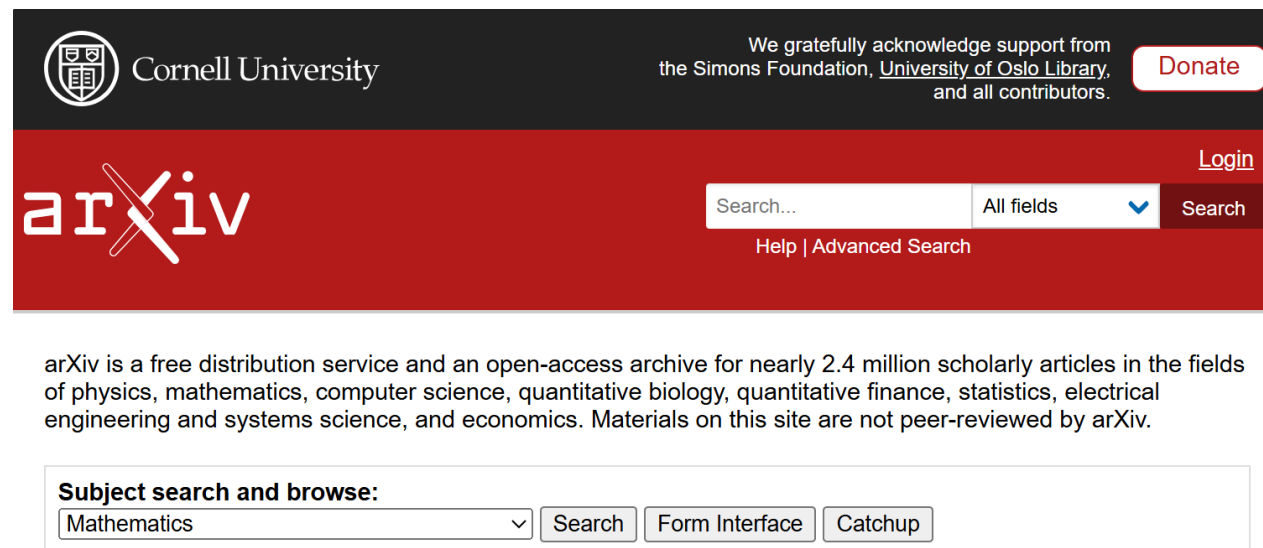
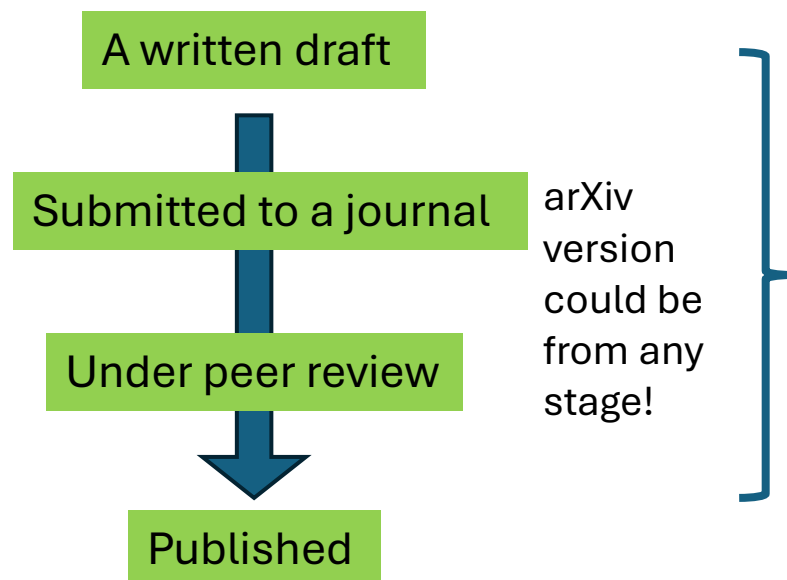
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- Discuss your findings with your peers

ACTION ITEM @ HOME: Read up for your project

- Ask your supervisor for suggestions of 1-2 core articles or books most relevant to your project
- Find these articles/books in one of the databases or the library
- Do **deep dive** and extract information from these articles/relevant sections of the books to learn the background for your project

Next steps:

- Use them as seeds for literature searches, follow the 'paper trail'
 - Look for articles cited in these articles and articles they cite



Generated with MS Copilot

Keep track of what you read

Make a reading journal:

- For each reference, write down main message + important points/results/proofs/theorems/figures/data &c. + page numbers

Reading record

Reference

1. Wiles, P. (1988) 'Teaching children in hospital' British Journal for Special Education. 15(4):158-62

2. Gabbay, M., V. Cowie, et al (2000) 'Too ill to learn: double jeopardy for sick children' Journal of the Royal Society of Medicine 93:114-117

Notes

In-depth study, 50+ hospitals in UK and US. Teachers make hospital stays more pleasant.

Sick children miss out on education and suffer education disadvantage.

Quotes

"For all children of whatever age, teachers can make the world of the hospital an exciting one where significant learning can take place" pg. 59

"Without education, sick children are further disadvantaged, and they, their families and society continue to count the financial and social costs for generations" pg. 116



Organize the literature you read

(so you can reference them later)

The logo for Zotero, featuring a red lowercase 'z' followed by the word 'otero' in a dark grey sans-serif font.

- Free, open-source reference management tool
- Features to annotate and organize files
- Integration with Word, Overleaf, BibTeX
- Free course from UiO Library!

Suppose you find a key proof you need for your project in an article.

What should you do?

- Make a detailed note in your reading record
- **REFERENCE** (i.e., cite) that article when you write up your thesis

Why reference?

Academic integrity

- All academic text is built upon others' work
- Acknowledge other researchers, give credit where it is due

Practical

- Show that you have read and understood relevant literature
- Put your own work in a broader context
- Show that you have produced new results, and discussed and compared them with previous results
- Enable the reader to locate your sources easily

How to reference mathematical literature

- Citation **in the text** where you use or refer to the information.
Common styles in mathematics (**bibLaTeX style name** in parenthesis):
 - **numbered** (**‘numeric’**: [1,2], [3], ...)
 - **alphanumeric abbreviations** (**‘alphabetic’**: [AM69, Gow01], ...)
 - **last name(s)-year** (**‘authoryear’**: Markwig et al. 2022, ...)
- (when appropriate) also specify which page/theorem/result
- All citations must appear in the **reference list**
- All citations and references must be written in a consistent style
 - Check with your advisor

Referencing scientific literature: example

5.2. Following the Growth of a Planet by N-Body Integrations

Computer modeling of the final stage of accretion has produced many simulations of the main growth stage of Earth and the other terrestrial planets (Wetherill 1992, Chambers & Wetherill 1998, Agnor et al. 1999, Chambers 2001). An example of such a history of the growth of Earth, with $\langle t \rangle = 26.7$ Myr, obtained by N-body simulation, is shown in Figure 9a (results from figure 13 of Agnor et al. 1999).

LITERATURE CITED

Agnor CB, Canup RM, Levison HF. 1999. On the character and consequences of large impacts in the late stage of terrestrial planet formation. *Icarus* 142:219–37

Amelin Y, Krot AN, Hutcheon ID, Ulyanov AA. 2002. Lead isotopic ages of chondrules and calcium-aluminum—rich inclusions. *Science* 297:1678–83

Cameron AGW. 2000. High-resolution simulations of the giant impact. See Canup & Righter 2000, pp. 133–44

Cameron AGW, Benz W. 1991. The origin of the moon and the single impact hypothesis. IV. *Icarus* 92:204–16

Cameron AGW, Ward WR. 1976. The Origin of the Moon. *Proc. Lunar Planet. Sci. Conf.* 7:120–22

Canup RM. 2004. Simulations of a late lunar-forming impact. *Icarus* 168:433–56

Canup RM, Agnor CB. 2000. Accretion of the terrestrial planets and the Earth-Moon system. See Canup & Righter 2000, pp. 113–29

List the references you cite,
cite the references you list

PLEASE READ:

Citation Guidelines in Mathematics (Kowalski)

Useful writing resources

- The mathematics web page at the library
- Krantz: A Primer of Mathematical Writing
- Halmos: How to write mathematics
- Fjordholm: A guide to writing mathematics
- Poonen: Practical suggestions for mathematical writing
- Lee: A Guide to Writing Mathematics
- Kowalski: About citations

It's only 3 pages! 😊

Example reference list
(E. Kowalski)

[MAT2000/STK-MAT2011 Spring 2026
course website](#)

REFERENCES

- [1] E. Bombieri, J. Friedlander and H. Iwaniec: *Primes in arithmetic progressions to large moduli*, Acta Math. 156 (1985), 203–251.
- [2] N. Bourbaki: *Elements of Mathematics*, Springer.
- [3] H. Davenport: *Multiplicative number theory*, Grad. Texts Math. 74, Springer (1980).
- [4] P. Deligne: *Théorie de Hodge, III*, Publ. Math. I.H.É.S 44 (1974), 5–77.
- [5] É. Fouvry: *Autour du théorème de Bombieri-Vinogradov*, Acta Math. 152 (1984), no. 3-4, 219–244.
- [6] A. Ghosh and P. Sarnak: *Real zeros of holomorphic cusp forms*, J. Europ. Math. Soc., to appear.
- [7] H. Helfgott: *Growth and generation in $SL_2(\mathbf{Z}/p\mathbf{Z})$* , Ann. of Math. 167 (2008), 601–623.
- [8] K. Matomaki: *Real zeros of holomorphic Hecke cusp forms and sieving short intervals*, preprint (2013).
- [9] A. Venkatesh: *Sparse equidistribution problems, period bounds and subconvexity*, Annals of Math. 172 (2010), 989–1094.
- [10] C. Voisin: *Hodge theory and complex algebraic geometry*, Cambridge University Press (2002).

It's easy to retrieve bibliographical information of sources from databases!



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University of Oslo

MR1844079 (2002k:11014)

Reviewed



Gowers, W. T. (4-CAMB-CM)

A new proof of Szemerédi's theorem.

Geom. Funct. Anal. **11** (2001), no. 3, 465–588.

Classifications

11B25 - Arithmetic progressions

11K38 - Irregularities of distribution, discrepancy

11K45 - Pseudo-random numbers; Monte Carlo methods

Citations

From References: 420

From Reviews: 57

zbMATH Open

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(py:2001 & au:gowers) & ti:szemerédi's theorem



Fields

Operators

Help

Gowers, W. T.

A new proof of Szemerédi's theorem. (English) [Zbl 1028.11005](#)

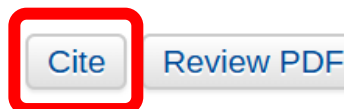
Geom. Funct. Anal. **11**, No. 3, 465–588 (2001); Erratum **11**, No. 4, 869 (2001).

The main result of the paper is the following improvement of *E. Szemerédi's theorem* [Acta Arith. 27, 199–245 (1975; [Zbl 0303.10056](#))]: For every positive integer k , every subset of $\{0, 1, \dots, N\}$ of size at least $N(\log \log N)^{-c}$ with $c = 2^{-2^{k+9}}$ contains an arithmetic progression of length k . This has an immediate consequence also for an estimate for the least integer $M = M(k, r)$ in van der Waerden's theorem on k term arithmetic progressions in partitions of the set $\{1, 2, \dots, M\}$ into r subsets. The main ingredients of the

Scroll down to the bottom...

Citations:

[Zbl 0303.10056](#)



Full Text: [DOI](#)

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(metadata to construct
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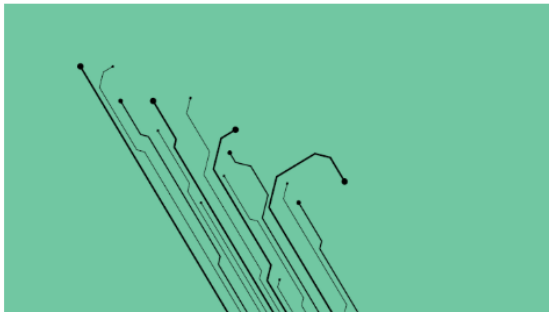
[Courses and workshops for students, staff and PhD students - University of Oslo Library](#)



Time and place: Feb. 25, 2026 9:15 AM – 12:00 PM, [Rom 209, Niels Henrik Abels hus](#)

Hvordan finne forskningslitteratur: Metoder og søketeknikker

Ikke gå glipp av relevante artikler! I dette kurset lærer du verktøy og teknikker for å finne artikler på en strukturert måte.



Time and place: Mar. 18, 2026 9:15 AM – 11:30 AM, Zoom

Zotero reference management tool

This course gives an introduction to the reference management software Zotero. The course is held in Zoom.



Time and place: Mar. 11, 2026 12:00 PM – 2:30 PM, [Room 209, Niels Henrik Abels hus](#)

Critical appraisal of articles

The aim of this course is to equip you with the knowledge and skills to critically appraise the methodological quality of a research article.