

The modified sharpened index h_{ms} and other variants in the Hirsch index zoo

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26.-29. November 2009, Universität Leipzig



The modified sharpened index h_{ms} and other variants in the Hirsch index zoo

1. Introduction: the Hirsch index h
2. The precision problem: the accuracy of the data base
3. Self-citation corrections: sharpening the Hirsch index h_s
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6. Egghe's g -index: one-hit wonders vs. enduring performers
7. The modified g -index g_m and the sharpened g -index g_s
8. Summary: words of caution



One-dimensional measures of scientific performance

total number of publications

$$n$$

total number of citations

$$s(n) = \sum_{r=1,n} c(r)$$

highest citation count

$$c(1)$$

average number of citations per paper

$$s(n)/n$$

median number of citations

number of significant papers (more than y citations)

$$n_y$$

total number of citations of significant papers

$$s(n_y)$$

average number of citations per significant paper

$$s(n_y)/n_y$$

normalization by impact factor

normalization by scientific age

**"Measure what is measurable, and
make measurable what is not so."**

Galileo Galilei (1564 - 1642)

The Hirsch index h


“A scientist has index h , if h of his/her n papers have at least h citations each and the other $n - h$ papers have no more than h citations each.”

Jorge E. Hirsch, *An index to quantify an individual's scientific research output*,
Proceedings of the National Accademy of Sciences USA **102**, 16569 - 16572 (2005)

“ h is the highest number of publications of a scientist
that received h or more citations each,
while the other papers have no more than h citations each.”

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Timespan=All Years. Databases=Science Citation Index Expanded (SCI-EXPANDED); Social Sciences Citation Index (SSCI); Arts & Humanities Citation Index (A&HCI); Index Chemicus (IC); Current Chemical Reactions (CCR-EXPANDED [back to 1840])

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- ☐ MEETING ABSTRACT (83)
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Author(s): Sherman A, Schreiber M
Source: **PHYSICAL REVIEW B** Volume: **76** Issue: **24** Article Number: **245112** Published: **2007**
Times Cited: **0**
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- ☐ 2. Title: [Colonoscopy preparation: Are our patients at risk?](#)
Author(s): Zuccaro G, Connor JT, Schreiber M
Source: **AMERICAN JOURNAL OF GASTROENTEROLOGY** Volume: **102** Issue: **12** Pages: **2664-2666** Published: **2007**
Times Cited: **0**
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- ☐ 3. Title: [Postmortem computed tomography, "CATopsy", predicts cause of death in trauma patients - Discussion](#)
Author(s): Schreiber M, Hoey BA, Champion H, et al.
Source: **JOURNAL OF TRAUMA-INJURY INFECTION AND CRITICAL CARE** Volume: **63** Issue: **5** Pages: **985-986**
Published: **2007**
Times Cited: **0**

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- ☐ 1. Title: [Control of cell cycle progression by c-Jun is p53 dependent](#)
Author(s): Schreiber M, Kolbus A, Piu F, et al.
Source: [GENES & DEVELOPMENT](#) Volume: 13 Issue: 5 Pages: 607-619 Published: 1999
Times Cited: 232
[Dokument verfügbar ?](#) [Full Text](#)
- ☐ 2. Title: [SYNDROMES OF VIBRIO-VULNIFICUS INFECTIONS - CLINICAL AND EPIDEMIOLOGIC FEATURES IN FLORIDA CASES, 1981-1987](#)
Author(s): KLONTZ KC, LIEB S, SCHREIBER M, et al.
Source: [ANNALS OF INTERNAL MEDICINE](#) Volume: 109 Issue: 4 Pages: 318-323 Published: 1988
Times Cited: 222
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- ☐ 3. Title: [MYXOMA VIRUS EXPRESSES A SECRETED PROTEIN WITH HOMOLOGY TO THE TUMOR-NECROSIS-FACTOR RECEPTOR GENE FAMILY THAT CONTRIBUTES TO VIRAL VIRULENCE](#)
Author(s): UPTON C, MACEN JL, SCHREIBER M, et al.
Source: [VIROLOGY](#) Volume: 184 Issue: 1 Pages: 370-382 Published: 1991
Times Cited: 206
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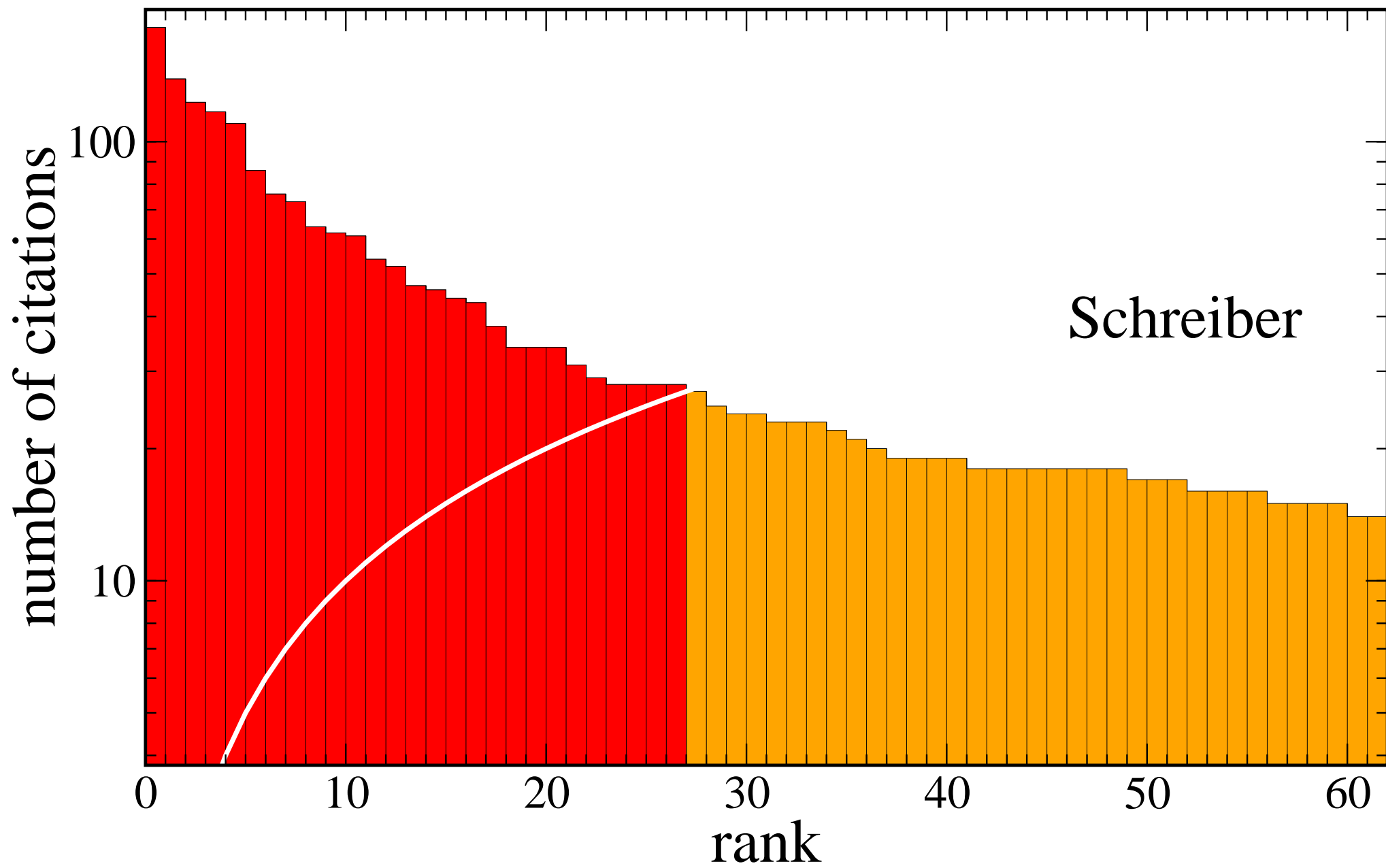
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- ☐ 44. Title: [Association of RET protooncogene codon 45 polymorphism with Hirschsprung disease](#)
Author(s): Fitze G, Schreiber M, Kuhlisch E, et al.
Source: **AMERICAN JOURNAL OF HUMAN GENETICS** Volume: **65** Issue: **5** Pages: **1469-1473** Published: **1999**
Times Cited: **53**
 
- ☐ 45. Title: [CELL PROLIFERATION AND CELL-CYCLE PROGRESSION ARE NOT IMPAIRED IN FIBROBLASTS AND ES CELLS LACKING C-FOS](#)
Author(s): BRUSSELBACH S, MOHLESTEINLEIN U, WANG ZQ, et al.
Source: **ONCOGENE** Volume: **10** Issue: **1** Pages: **79-86** Published: **1995**
Times Cited: **53**

- ☐ 46. Title: [DOES BROKEN TIME-REVERSAL SYMMETRY MODIFY THE CRITICAL-BEHAVIOR AT THE METAL-INSULATOR-TRANSITION IN 3-DIMENSIONAL DISORDERED-SYSTEMS](#)
Author(s): HOFSTETTER E, SCHREIBER M
Source: **PHYSICAL REVIEW LETTERS** Volume: **73** Issue: **23** Pages: **3137-3140** Published: **1994**
Times Cited: **53**
 
- ☐ 47. Title: [THE MYXOMA VIRUS TNF-RECEPTOR HOMOLOG \(T2\) INHIBITS TUMOR NECROSIS FACTOR-ALPHA IN A SPECIES-SPECIFIC FASHION](#)
Author(s): SCHREIBER M, MCFADDEN G
Source: **VIROLOGY** Volume: **204** Issue: **2** Pages: **692-705** Published: **1994**
Times Cited: **52**
 
- ☐ 48. Title: [DETERMINATION OF THE MOBILITY EDGE IN THE ANDERSON MODEL OF LOCALIZATION IN 3-DIMENSIONS BY MULTIFRACTAL ANALYSIS](#)
Author(s): GRUSSBACH H, SCHREIBER M
Source: **PHYSICAL REVIEW B** Volume: **51** Issue: **1** Pages: **663-666** Published: **1995**
Times Cited: **49**

- ☐ 49. Title: [Regulation of cancer cell migration and bone metastasis by RANKL](#)
Author(s): Jones DH, Nakashima T, Sanchez OH, et al.
Source: **NATURE** Volume: **440** Issue: **7084** Pages: **692-696** Published: **2006**
Times Cited: **47**
 
- ☐ 50. Title: [Myxoma virus T2 protein, a tumor necrosis factor \(TNF\) receptor homolog, is secreted as a monomer and dimer that each bind rabbit TNF alpha, but the dimer is a more potent TNF inhibitor](#)



The precision problem

- homographs
- special characters: ä, ö, ü
- suffix: von, de
- incomplete initials
- hyphenated names
- name changes: marriage
- translation or transliteration from other alphabets

wrong references

missing references from books and proceedings

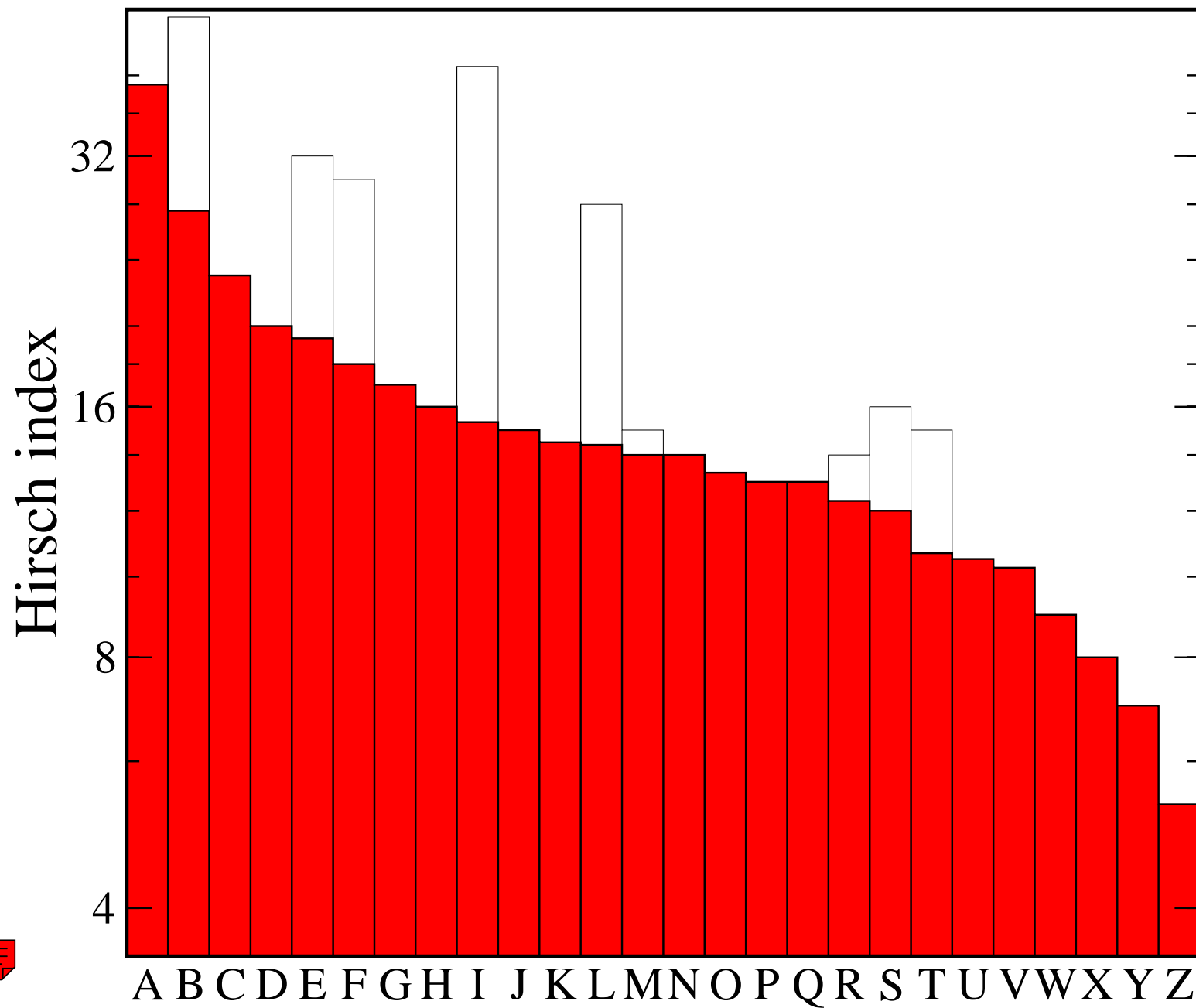
missing publications in books and proceedings

Two data sets

26 professors and senior assistants

from the Institute of Physics at Chemnitz University of Technology

7 prominent physicists from Hirsch's paper and J.E. Hirsch himself



“Citation analysis is not a shortcut to be used as a replacement for thinking”

Garfield, E. *Current Contents*, 45, 5-14 (1983).

How to use citation analysis for faculty evaluations, and when is it relevant?

Self-citation corrections: the sharpened index h_s

self-citations do not reflect the visibility or impact of a publication

necessary self-citations (“I do not want to repeat myself”)

easy self-citations (“I know my previous publications”)

unnecessary self-citations (“no one cites my previous publications”)

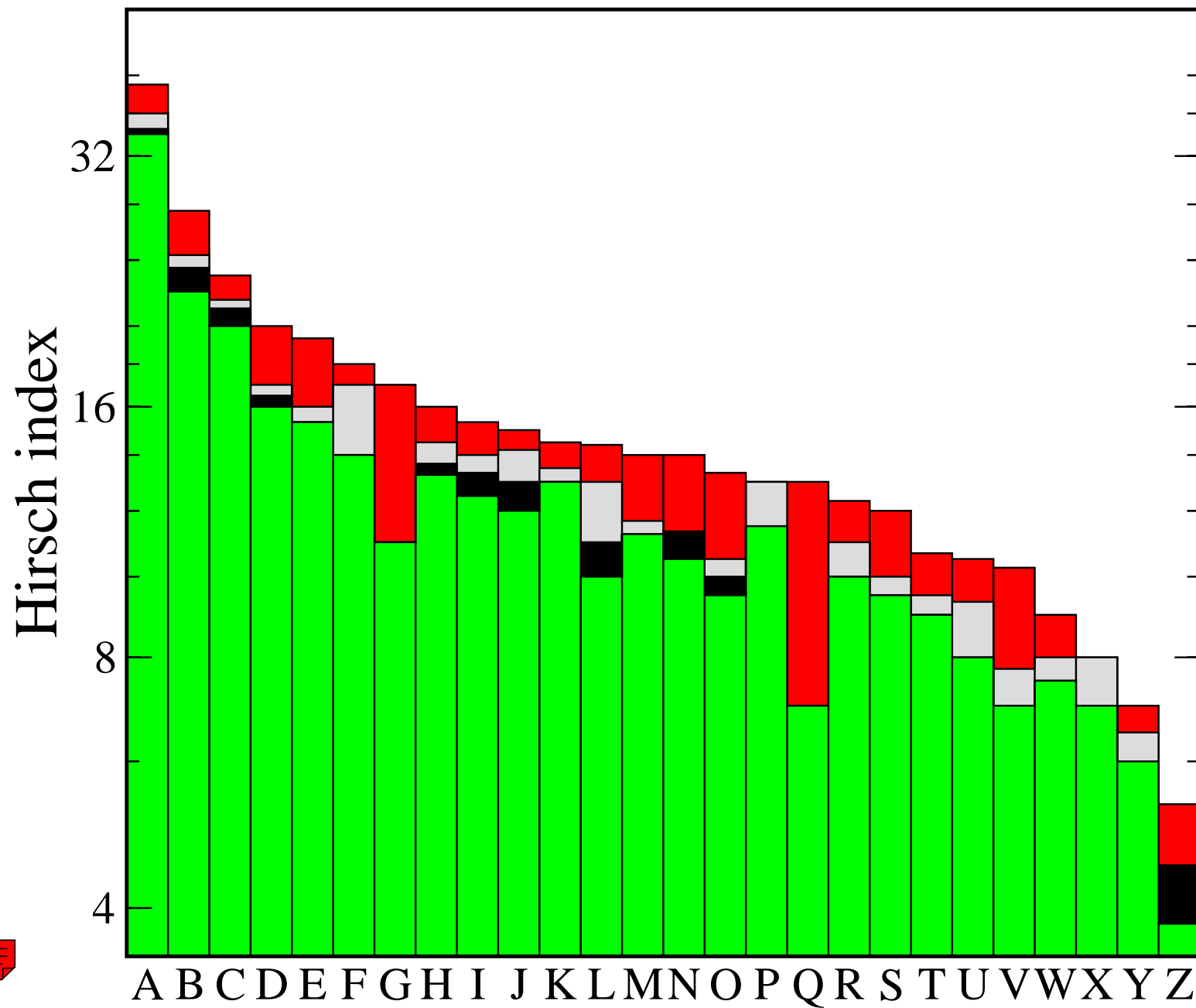
direct (own) self-citations: h_o

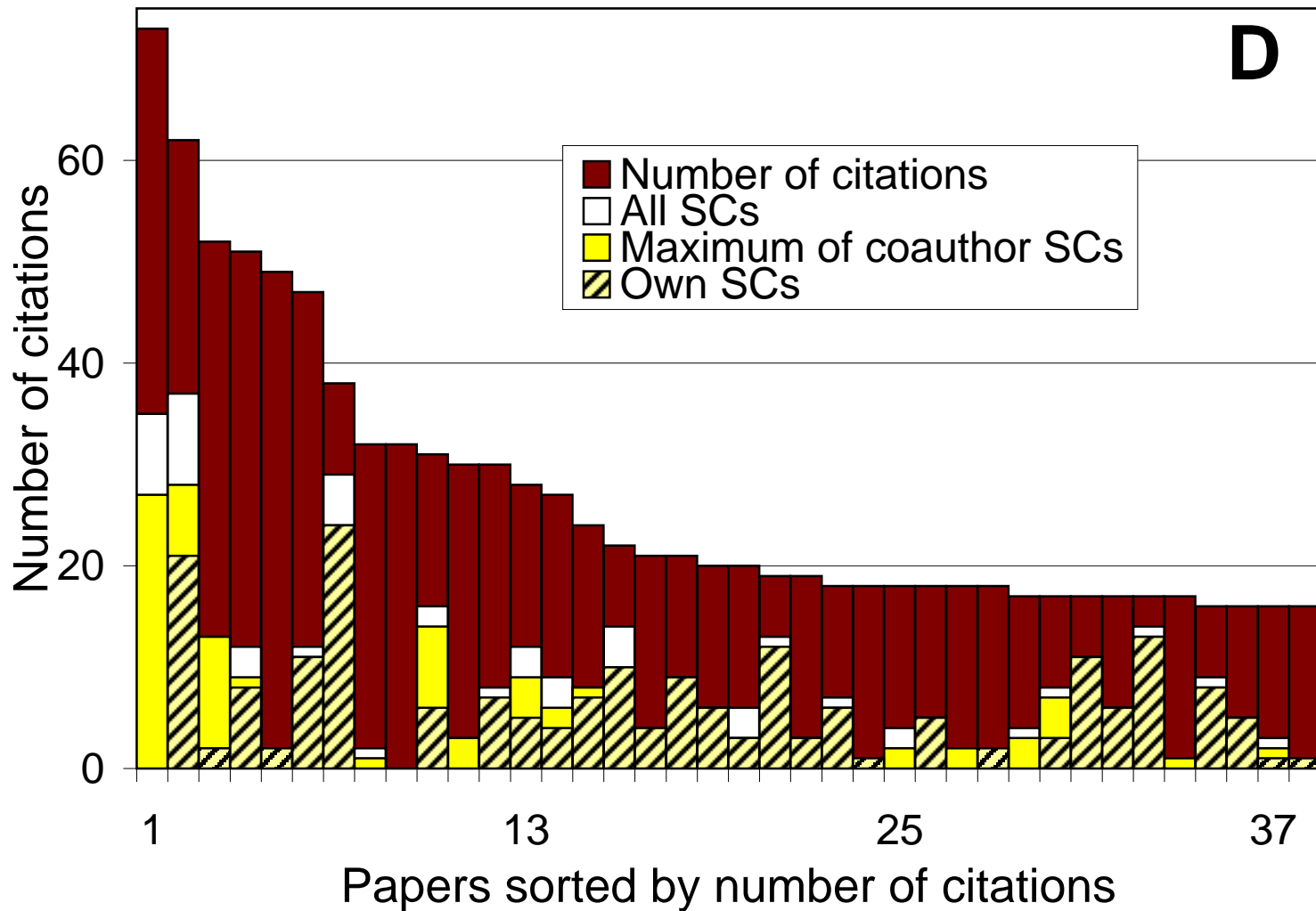
an enthusiastic co-author: h_c

all author self-citations: h_s

M.S., Ann. Phys. **16**, 640 - 652 (2007)

M.S., EPL **78**, 30002 - 1-6 (2007)



D

**“Not everything that counts can be counted.
And not everything that can be counted counts.”**

(attributed to A. Einstein)

Multi-author manuscripts: the fractional index h_f

h_i : normalize h by the average number of co-authors:
sensitive to extreme values

h_f : sharing the number of citations:
fractionalized citation count

$$c_{eff}(r) = c(r)/a(r)$$

Multi-author manuscripts: the modified index h_m

h_f : sharing the number of citations:
fractionalized citation count $c_{eff}(r) = c(r)/a(r)$

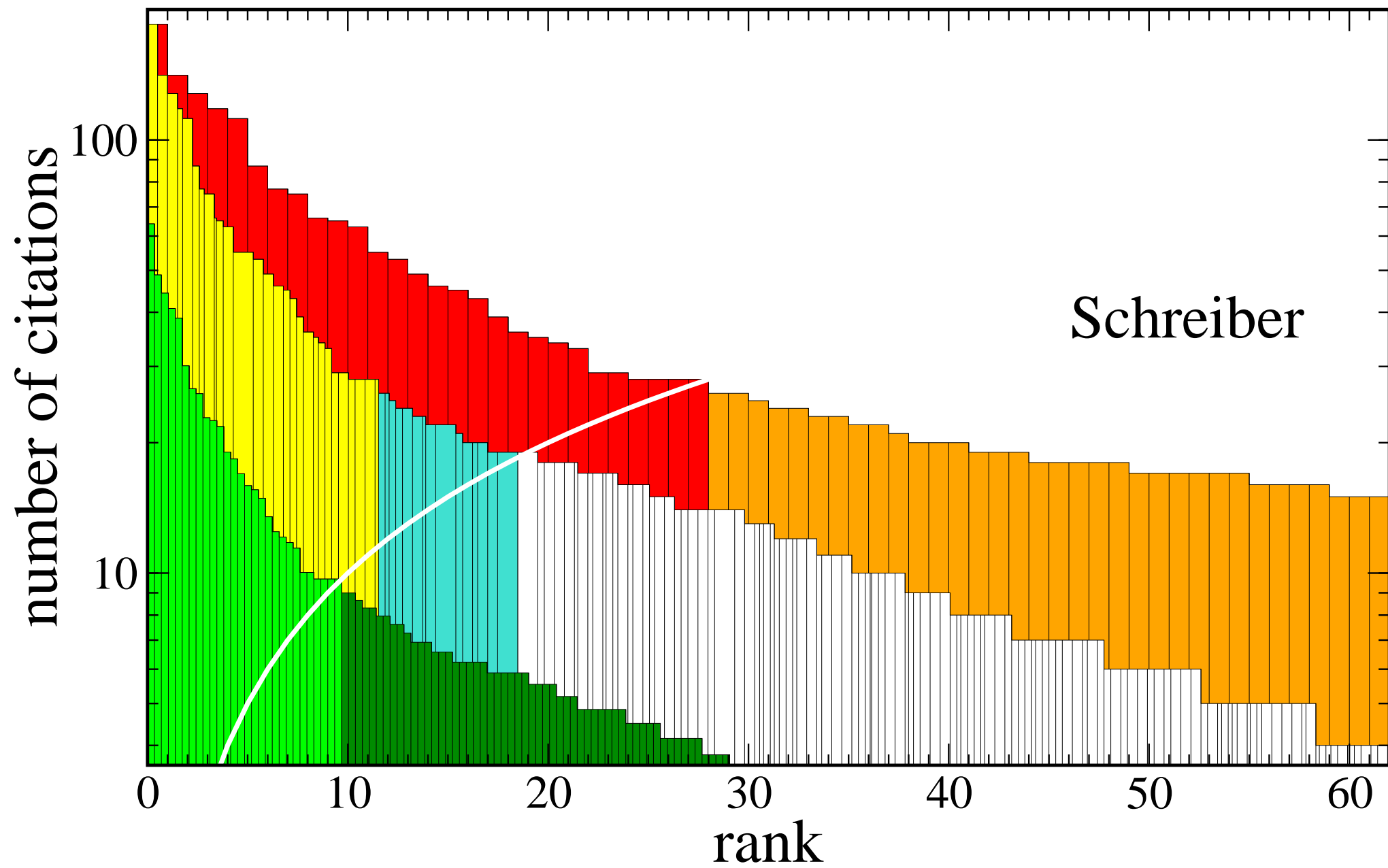
h_m : sharing the number of publications:
fractionalized paper count $1/a(r)$

i.e. each paper with $a(r)$ authors counts only $1/a(r)$ instead of 1
 \Rightarrow effective rank or effective number $r_{eff}(r) = \sum_{r'=1, r} 1/a(r')$

“ h_m is the highest **effective** number of publications of a scientist that received h_m or more citations each, while the other papers have no more than h_m citations each.”

M.S., New J. Phys. **10**, 040201-1-9 (2008)

M.S., J. Am. Soc. Inf. Sci. Techn. **60**, 1274-1282 (2009)



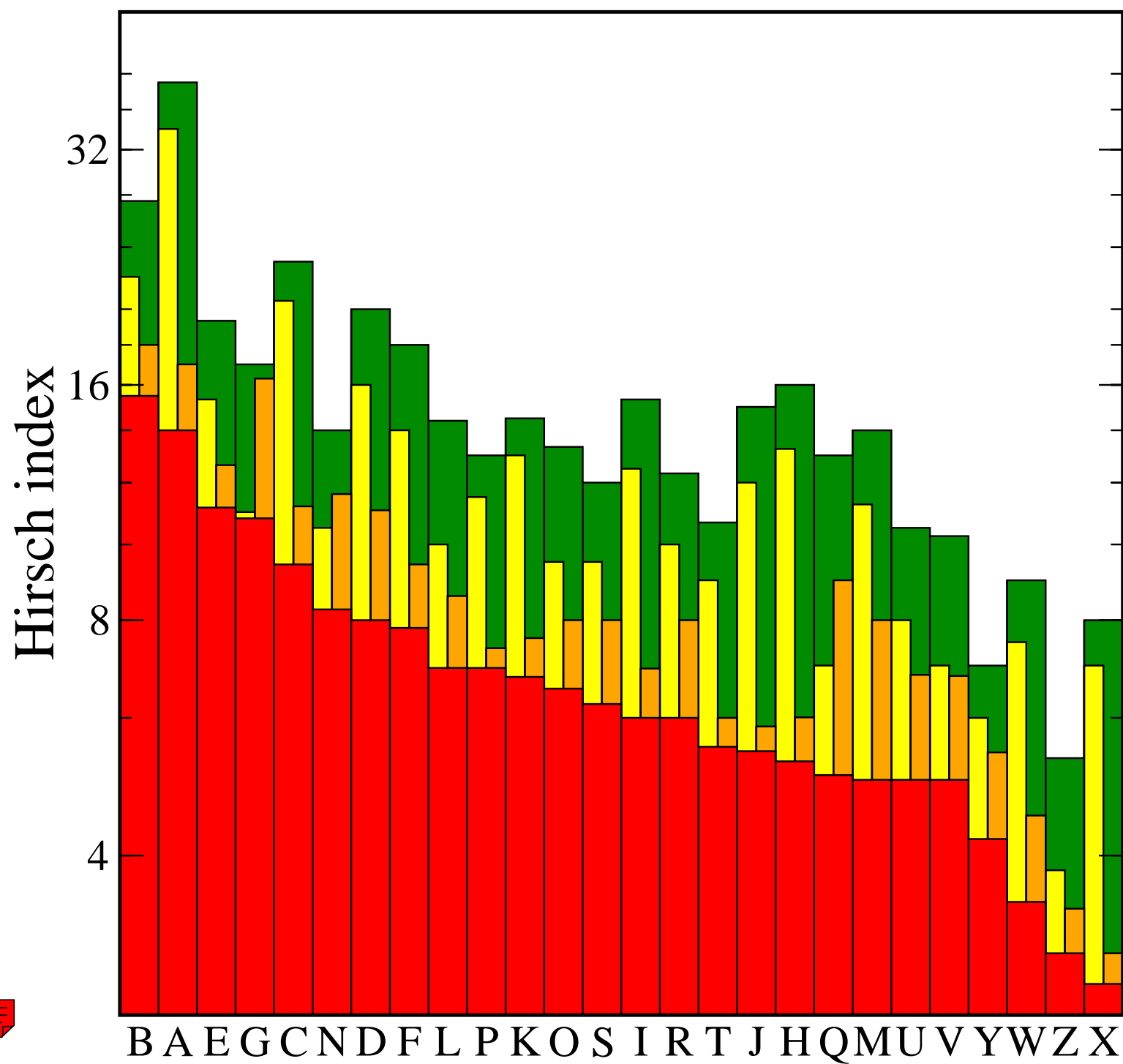
Multi-author manuscripts *and* self-citation corrections: the modified sharpened index h_{ms}

h_m : fractionalized paper count

h_s : independent citations (i.e. counted without self-citations)

“ h_{ms} is the highest **effective** number of publications of a scientist that received h_{ms} or more **independent** citations each, while the other papers have no more than h_{ms} independent citations each.”

M.S., Ann. Phys. **18**, 607 - 621 (2009)



“A good decision is based on knowledge not on numbers”

Platon 428 – 348 BC

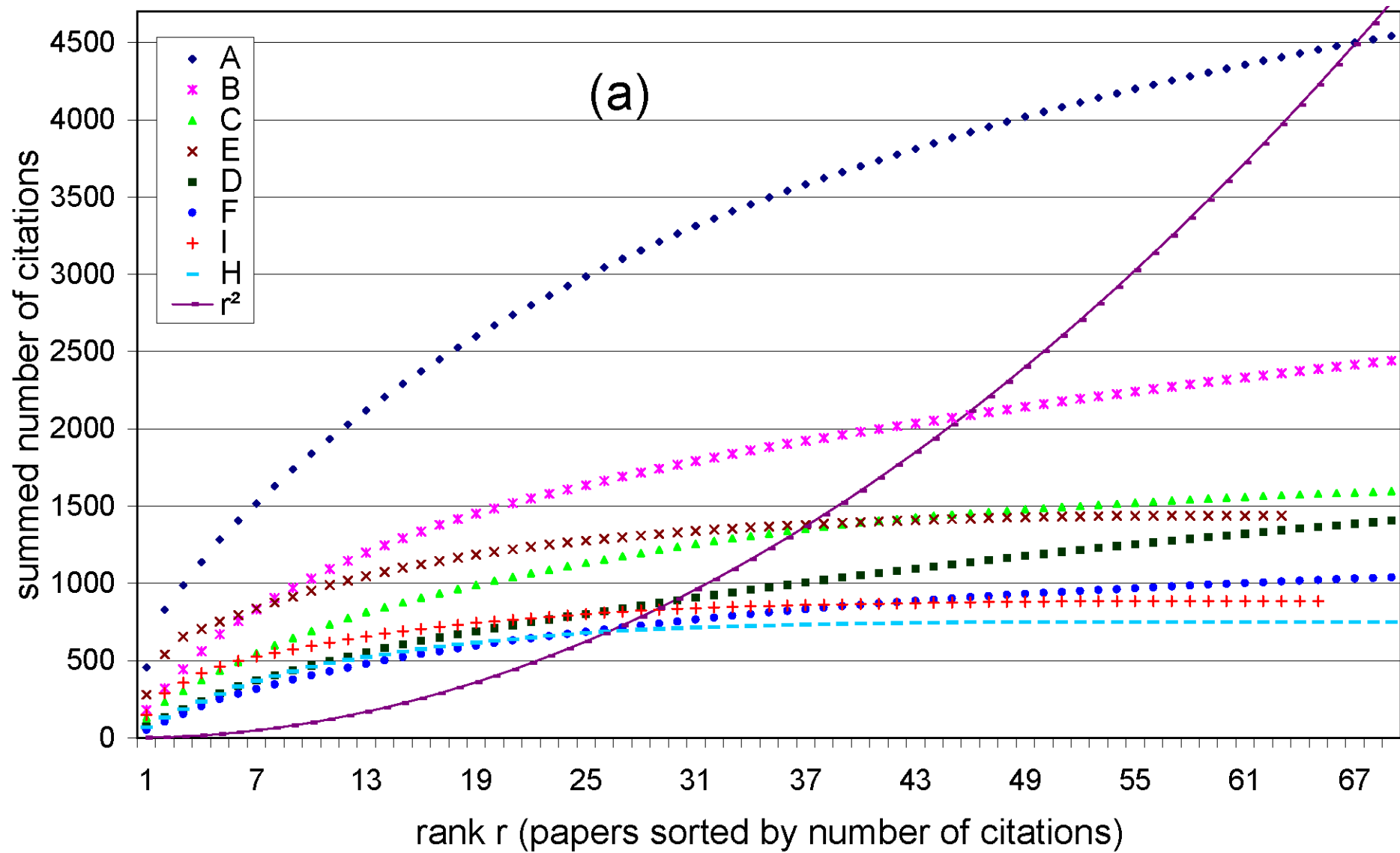
Weighting high citation counts: Egghe's g -index

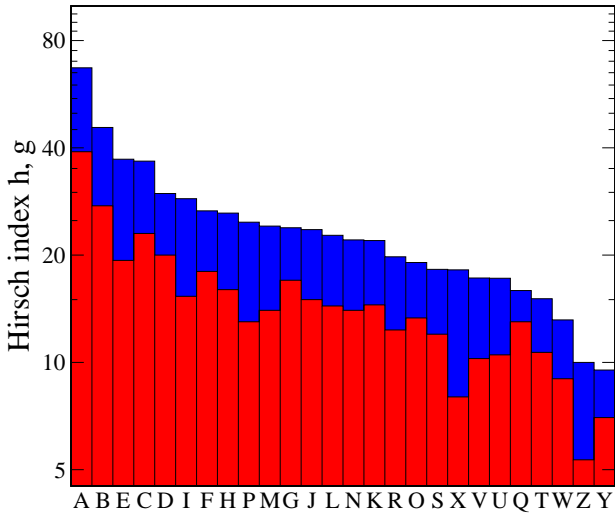
“ g is the highest number of publications of a scientist that **together** received g^2 or more citations.”

$$s(g) \geq g^2 \qquad s(r) = \sum_{r'=1,r} c(r')$$

$$c(h) \geq h$$

M.S., J. Am. Soc. Inf. Sci. Techn. **59**, 1513-1522 (2008)





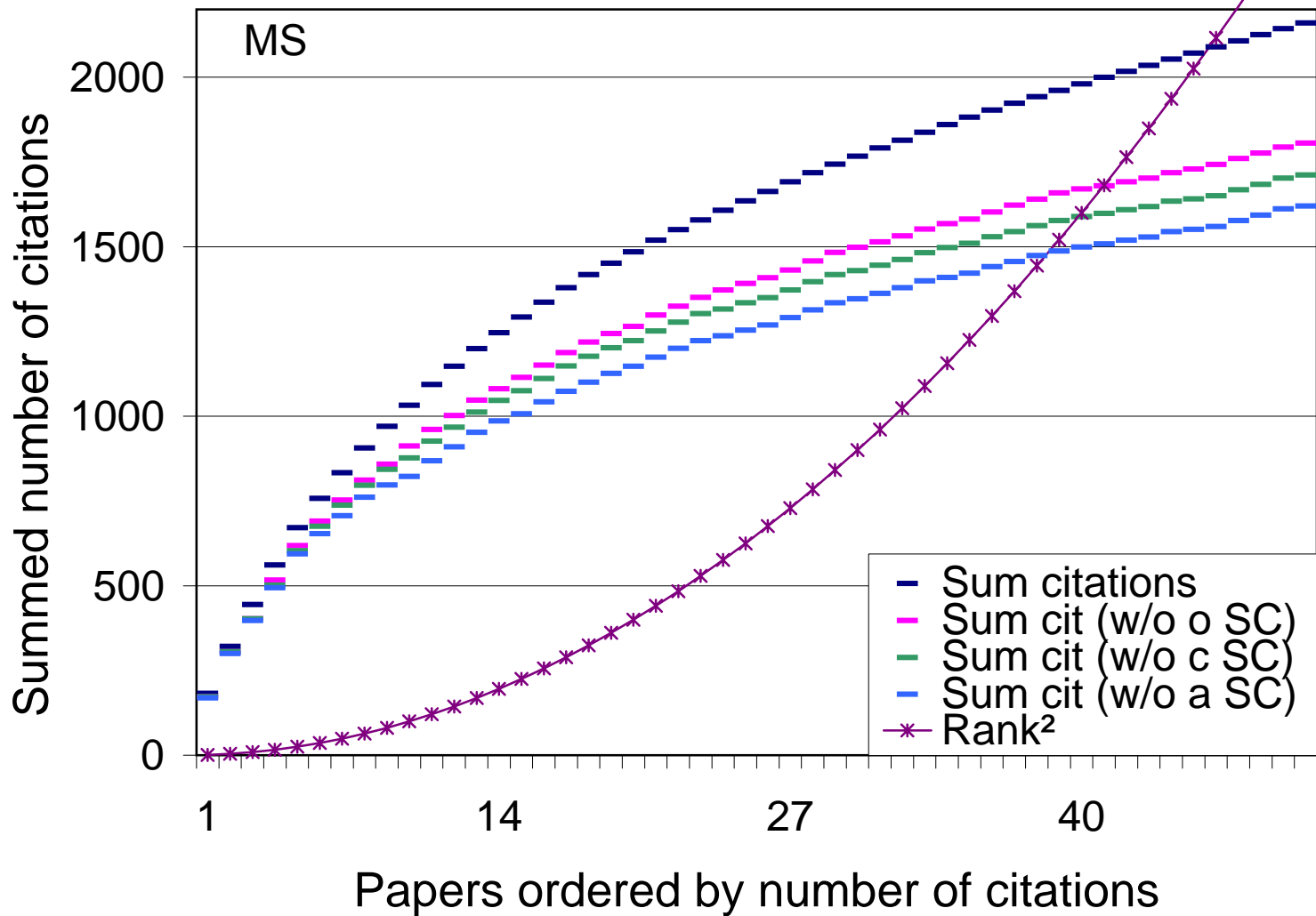
Self-citation corrections: the sharpened index g_s

direct (own) self-citations: g_o

an enthusiastic co-author: g_c

all author self-citations: g_s

M.S., *Scientometrics* **76**, 187-200 (2008)



Multi-author manuscripts: the modified index g_m

g_f : sharing the number of citations:
fractionalized citation count $c_{eff}(r) = c(r)/a(r)$

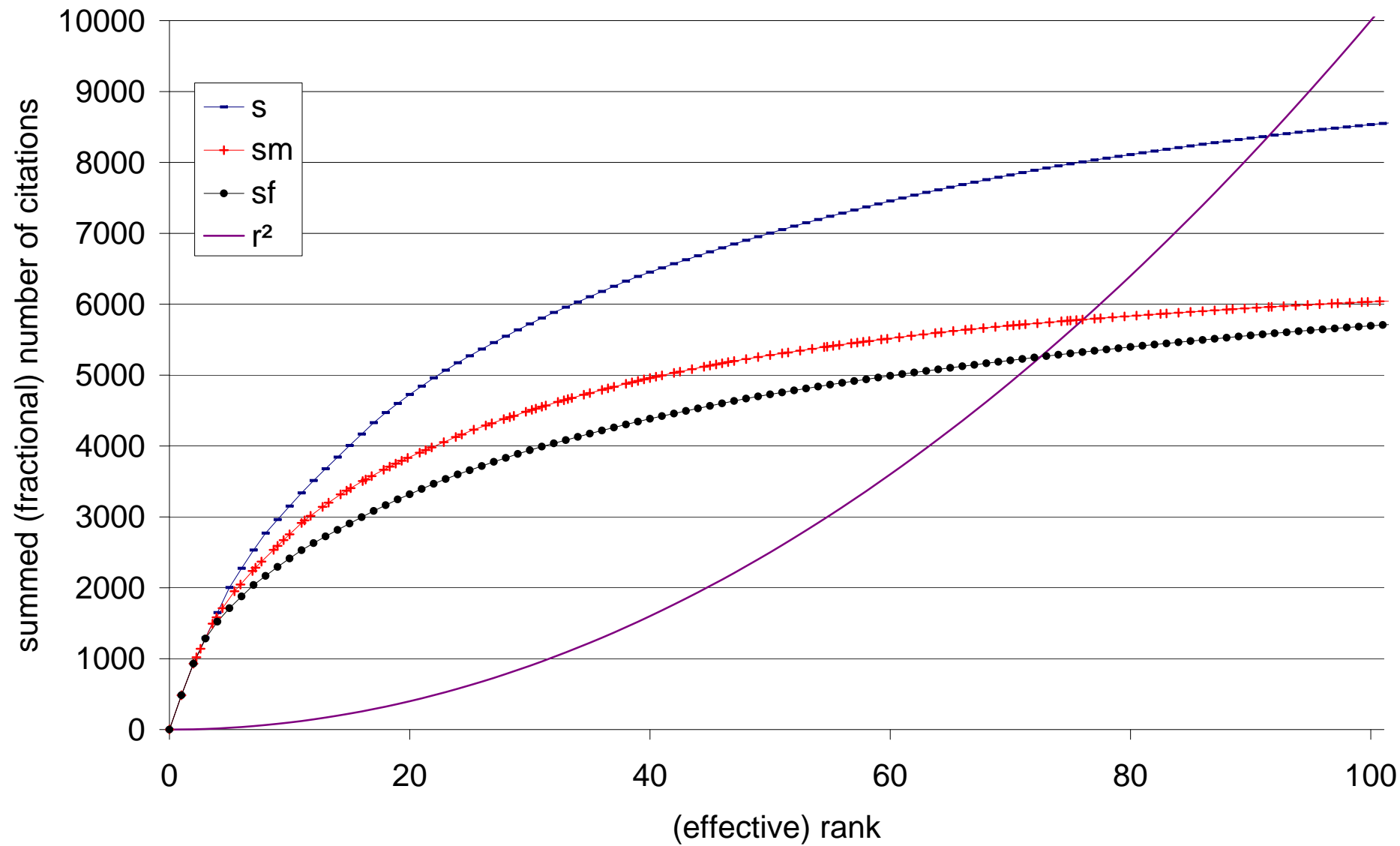
g_m : sharing the number of publications:
fractionalized paper count $1/a(r)$

\Rightarrow effective rank or effective number $r_{eff}(r) = \sum_{r'=1,r} 1/a(r')$

“ g_m is the highest **effective** number of publications of a scientist that together received g_m or more fractionally counted citations each”

$$s_{eff}(g_m) \geq g_m^2 \quad s_{eff}(r_{eff}) = \sum_{eff} c(r') = \sum_{r'=1,r} c(r') / a(r')$$

M.S., J. Informetrics, in print (2009)



Weighting high citation counts: The g -index revisited

“ g is the highest number of publications of a scientist that **together** received g^2 or more citations.”

is equivalent to

“ g is the highest number of publications of a scientist that received g or more citations **on average**”

$$s(g) \geq g^2$$

$$s(r) = \sum_{r'=1,r} c(r')$$

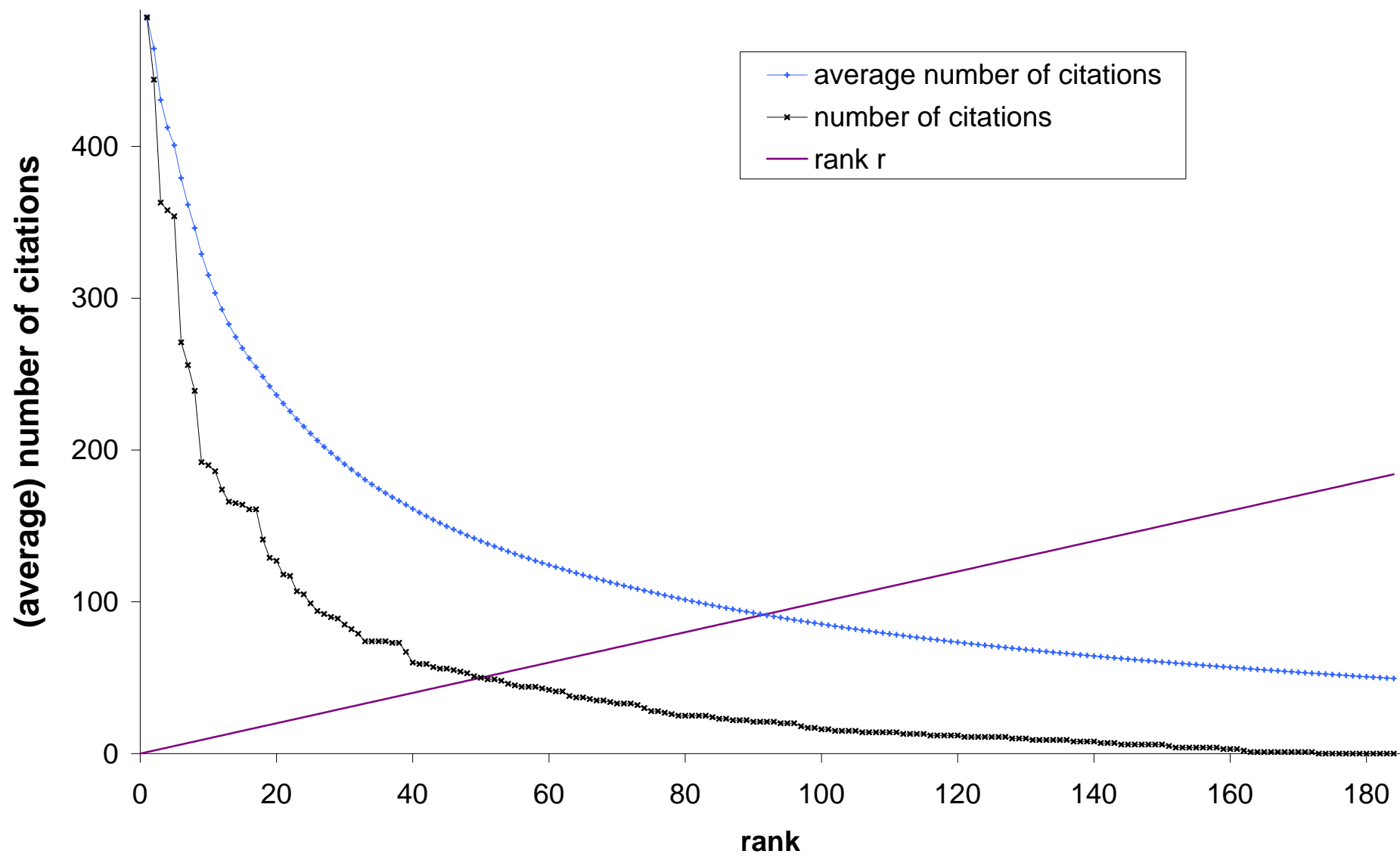
$$s(g)/g \geq g$$

$$s(r)/r = \sum_{r'=1,r} c(r')/r = c_{av}(r)$$

$$c_{av}(g) \geq g$$

$$c_{av}(h) = A$$

M.S., J. Am. Soc. Inf. Sci. Techn. **61**, in print (2010)

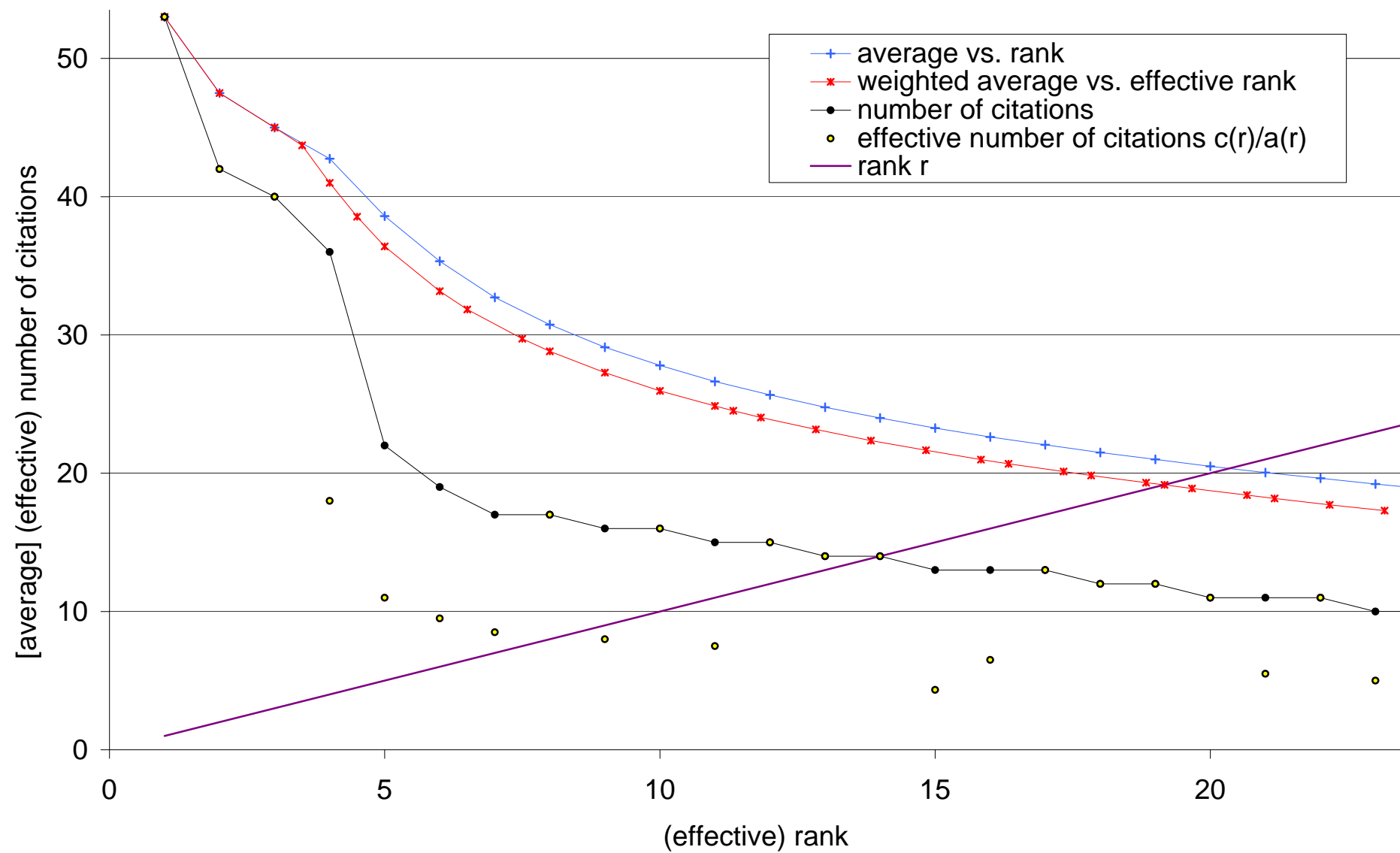


Weighting high citation counts: The g_m -index revisited

“ g_m is the highest effective number of publications of a scientist that received g_m or more fractionally counted citations **on average**”

$$s_{\text{eff}}(g_m)/g_m \geq g_m \qquad s_{\text{eff}}(r_{\text{eff}})/r_{\text{eff}} = \sum_{\text{eff}} c(r') / r_{\text{eff}} = c_{\text{eff}, \text{av}}(r_{\text{eff}})$$

M.S., J. Am. Soc. Inf. Sci. Techn. **60**, 2145-2150 (2009)



Summary

Establishing the data base correctly is not easy.

Self-citations can dramatically enhance the h -index.

Co-authorship can be easily accounted for by fractionalized counting of publications.

High citation counts are appropriately considered in the g -index.

Caution

It is dangerous to reduce a life-time's work to a number.

“Uncertainties make the concerted use of citation analysis and peer evaluation inevitable”
“The necessary caution can not in principle be exercised by science administrators”

G. Folly, B. Hajtman, J.I. Nagy, and I. Ruff, *Some methodological problems in ranking scientists by citation analysis*, *Scientometrics* **3**, 135-147 (1981)

ALL DATABASES

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Results Topic=(Hirsch) AND Author=(Schreiber M)

Refined by: [excluding] Authors=(SHERMAN, A)

Refined by: All Years

Results: 9

Page 1 of 1 Go

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Analyze Results

Save to EndNote, RefMan, ProCite more options

1. Title: A case study of the Hirsch index for 26 non-prominent physicists

Author(s): Schreiber, M

Source: **ANNALEN DER PHYSIK** Volume: 16 Pages: 640-652

Published: 2007

Times Cited: 19

Full Text

2. Title: Self-citation corrections for the Hirsch index

Author(s): Schreiber, M

Source: **EPL** Volume: 78 Issue: 3 Article Number: 30002 Published: 2007

Times Cited: 13

Full Text

3. Title: A modification of the h-index: The h(m)-index accounts for multi-authored manuscripts

Author(s): Schreiber, M

Source: **JOURNAL OF INFORMETRICS** Volume: 2 Issue: 3 Pages: 211-216 Published: 2008

Times Cited: 9

Full Text

4. Title: The influence of self-citation corrections on Egghe's g index

Author(s): Schreiber, M

Source: **SCIENTOMETRICS** Volume: 76 Issue: 1 Pages: 187-200

Published: 2008

Times Cited: 9

Full Text

5. Title: An empirical investigation of the g-index for 26 physicists in comparison with the h-Index, the A-index, and the R-index

Author(s): Schreiber, M

Source: **JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY** Volume: 59 Issue: 9 Pages: 1513-1522

Published: 2008

Times Cited: 8

Full Text

6. Title: To share the fame in a fair way, h(m) modifies h for multi-authored manuscripts

Author(s): Schreiber, M

Source: **NEW JOURNAL OF PHYSICS** Volume: 10 Article Number: 040201 Published: 2008

Times Cited: 6

Full Text

7. Title: A Case Study of the Modified Hirsch Index h(m) Accounting for Multiple Coauthors

Author(s): Schreiber, M

Source: **JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY** Volume: 60 Issue: 6 Pages: 1274-1282

Published: 2009

Times Cited: 2

Full Text

8. Title: The influence of self-citation corrections and the fractionalised counting of multi-authored manuscripts on the Hirsch index

Author(s): Schreiber, M

Source: **ANNALEN DER PHYSIK** Volume: 18 Issue: 9 Pages: 607-621

Published: 2009

Times Cited: 0

Full Text

9. Title: Fractionalized Counting of Publications for the g-Index

Author(s): Schreiber, M

Source: **JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE AND TECHNOLOGY** Volume: 60 Issue: 10 Pages: 2145-2150 Published: 2009

Times Cited: 0

Full Text

Results: 9

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