

Fraud in Physics: Schön - Batlogg Case

Jan Hendrik Schön - PhD (1997) University of Konstanz - Post-Doc at Bell Labs

Bertram Batlogg - Senior Scientific Staff at Bell Labs - Schön's supervisor

- ❖ 2001 - claimed discovery of single molecular transistor and many new phenomena in organic materials
- ❖ 2001 - co-authored a paper on average *every 8 days!!*
- ❖ evidence of fraud detected by Professors Lydia Sohn (Princeton University) & Paul McKwen (Cornell)
- ❖ Extent and nature of the fraud was shocking
- ❖ High public profile:
 - number of fraudulent reports in prestigious journals
 - hot field (nano-science and nano-technology)
 - distinguished senior scientist at most prestigious industrial lab in the world.

The scandal provoked discussion in the scientific community about the degree of responsibility of coauthors and reviewers of scientific papers.

What are our responsibilities as reviewers of scientific reports and scientific proposals?

Sources:

1. Beasley, Malcolm R.; Supriyo Datta, Herwig Kogelnik, Herbert Kroemer (September 2002). "[Report of the Investigation Committee on the possibility of Scientific Misconduct in the work of Hendrik Schon and Coauthors](#)" (pdf). Bell Labs.
2. The rise and fall of a physics fraudster, *Physics World*, **22**(5), May 2009, page 24.
3. *Plastic Fantastic: How the Biggest Fraud in Physics Shook the Scientific World*, Macmillan 2009, by E. S. Reich.

Withdrawn journal papers = 28

On October 31, 2002, *Science* withdrew **eight papers** written by Schön:[14]

- J. H. Schön, S. Berg, Ch. Kloc, B. Batlogg (2000). "Ambipolar Pentacene Field-Effect Transistors and Inverters". *Science* **287** (5455): 1022. doi:10.1126/science.287.5455.1022. PMID 10669410.
- J. H. Schön, Ch. Kloc, R. C. Haddon, B. Batlogg (2000). "A Superconducting Field-Effect Switch". *Science* **288** (5466): 656. doi:10.1126/science.288.5466.656. PMID 10784445.
- J. H. Schön, Ch. Kloc, B. Batlogg (2000). "Fractional Quantum Hall Effect in Organic Molecular Semiconductors". *Science* **288** (5475): 2338. doi:10.1126/science.288.5475.2338. PMID 17769842.
- J. H. Schön, H. Meng, Z. Bao (2000). "An Organic Solid State Injection Laser". *Science* **289** (5479): 599. Bibcode 2000Sci...289..599S. doi:10.1126/science.289.5479.599. PMID 10915617.
- J. H. Schön, Ch. Kloc, B. Batlogg (2000). "A Light-Emitting Field-Effect Transistor". *Science* **290** (5493): 963. Bibcode 2000Sci...290..963S. doi:10.1126/science.290.5493.963. PMID 11062124.
- J. H. Schön, Ch. Kloc, H. Y. Hwang, B. Batlogg (2001). "Josephson Junctions with Tunable Weak Links". *Science* **292** (5515): 252. doi:10.1126/science.1058812. PMID 11303093.
- J. H. Schön, A. Dodabalapur, Ch. Kloc, B. Batlogg (2001). "High-Temperature Superconductivity in Lattice-Expanded C60". *Science* **293** (5539): 2432. doi:10.1126/science.1064773. PMID 11533443.
- J. H. Schön, Ch. Kloc, A. Dodabalapur, B. Batlogg (2001). "Field-Effect Modulation of the Conductance of Single Molecules". *Science* **294** (5549): 2138. doi:10.1126/science.1066171. PMID 11701891.

On December 20, 2002, *Physical Review* withdrew **six papers** written by Schön:[15][16]

- J. H. Schön, Ch. Kloc, B. Batlogg (2001). "Hole transport in pentacene single crystals". *Physical Review B* **63**: 245201. Bibcode 2001PhRvB..63x5201S. doi:10.1103/PhysRevB.63.245201.
- J. H. Schön, Ch. Kloc, R. Laudise, B. Batlogg (1998). "Electrical properties of single crystals of rigid rodlike conjugated molecules". *Physical Review B* **58**: 12952. Bibcode 1998PhRvB..58i12952S. doi:10.1103/PhysRevB.58.12952.
- J. H. Schön, Ch. Kloc, B. Batlogg (2000). "Mobile iodine dopants in organic semiconductors". *Physical Review B* **61**: 10803. Bibcode 2000PhRvB..61i10803S. doi:10.1103/PhysRevB.61.10803.
- J. H. Schön, Ch. Kloc, D. Fichou, B. Batlogg (2001). "Conjugation length dependence of the charge transport in oligothiophene single crystals". *Physical Review B* **64**: 035209. Bibcode 2001PhRvB..64c5209S. doi:10.1103/PhysRevB.64.035209.
- J. H. Schön, Ch. Kloc, B. Batlogg (2001). "Low-temperature transport in high-mobility polycrystalline pentacene field-effect transistors". *Physical Review B* **63**: 125304. Bibcode 2001PhRvB..63i5304S. doi:10.1103/PhysRevB.63.125304.
- J. H. Schön, Ch. Kloc, B. Batlogg (2001). "Universal Crossover from Band to Hopping Conduction in Molecular Organic Semiconductors". *Physical Review Letters* **86** (17): 3843. Bibcode 2001PhRvL..86.3843S. doi:10.1103/PhysRevLett.86.3843. PMID 11329338.

On February 24, 2003, *Applied Physics Letters* withdrew **four papers** written by Schön:[17][18][19][20]

- J. H. Schön, Z. Bao (2002). "Nanoscale organic transistors based on self-assembled monolayers". *Applied Physics Letters* **80** (5): 847. Bibcode 2002ApPhL..80..847S. doi:10.1063/1.1445804.
- J. H. Schön, C. Kloc (2001). "Fast organic electronic circuits based on ambipolar pentacene field-effect transistors". *Applied Physics Letters* **79** (24): 4043. Bibcode 2001ApPhL..79.4043S. doi:10.1063/1.1426684.
- J. H. Schön (2001). "Plastic Josephson junctions". *Applied Physics Letters* **79** (4): 2208. Bibcode 2001ApPhL..79.2208S. doi:10.1063/1.1408277.
- J. H. Schön, C. Kloc, B. Batlogg (2000). "Perylene: A promising organic field-effect transistor material". *Applied Physics Letters* **77** (23): 3776. Bibcode 2000ApPhL..77.3776S. doi:10.1063/1.1329634.

On May 2, 2003, *Science* withdrew **another paper** written by Schön:[21]

- J. H. Schön, M. Dorget, F. C. Beuran, X. Z. Xu, E. Arushanov, M. Laguës, C. Deville Cavellin (2001). "Field-Induced Superconductivity in a Spin-Ladder Cuprate". *Science* **293** (5539): 2430. Bibcode 2001Sci...293.2430S. doi:10.1126/science.1064204.

On March 20, 2003, *Advanced Materials* withdrew **two papers** written by Schön:[22]

- J. H. Schön, H. Meng, Z. Bao (2002). "Self-Assembled Monolayer Transistors". *Advanced Materials* **14** (4): 323–326. doi:10.1002/1521-4095(20020219)14:4<323::AID-ADMA323>3.0.CO;2-5.
- J. H. Schön, C. Kloc, J. Wildeman, G. Hadziioannou (2001). "Gate-Induced Superconductivity in Oligophenylenevinylene Single Crystals". *Advanced Materials* **13** (16): 1273–1274. doi:10.1002/1521-4095(200108)13.

On March 5, 2003, *Nature* withdrew **seven papers** written by Schön:[23]

- J. H. Schön, M. Dorget, F. C. Beuran, X. Z. Xu, E. Arushanov, C. Deville Cavellin, M. Laguës (2001). "Superconductivity in CaCuO₂ as a result of field-effect doping". *Nature* **414** (6862): 434. doi:10.1038/35106539.
- J. H. Schön, Ch. Kloc, T. Siegrist, M. Steigerwald, C. Svensson, B. Batlogg (2001). "Superconductivity in single crystals of the fullerene C70". *Nature* **413** (6858): 831. doi:10.1038/35101577. PMID 11677603.
- J. H. Schön, H. Meng, Z. Bao (2001). "Self-assembled monolayer organic field-effect transistors". *Nature* **413** (6857): 713. Bibcode 2001Natur.413..713S. doi:10.1038/35099520. PMID 11607026.
- J. H. Schön, A. Dodabalapur, Z. Bao, Ch. Kloc, O. Schenker, B. Batlogg (2001). "Gate-induced superconductivity in a solution-processed organic polymer film". *Nature* **410** (6825): 189. doi:10.1038/35065565.
- J. H. Schön, Ch. Kloc, B. Batlogg (2000). "Superconductivity at 52 K in hole-doped C60". *Nature* **408** (6812): 549. doi:10.1038/35046008. PMID 11117735.
- J. H. Schön, Ch. Kloc, B. Batlogg (2000). "Superconductivity in molecular crystals induced by charge injection". *Nature* **406** (6797): 702. Bibcode 2000Natur.406..702S. doi:10.1038/35021011. PMID 10963589.
- J. H. Schön, Ch. Kloc, E. Bucher, B. Batlogg (2000). "Efficient organic photovoltaic diodes based on doped pentacene". *Nature* **403** (6768): 408. Bibcode 2000Natur.403..408S. doi:10.1038/35000172. PMID 10667788.

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National Science Foundation Requirement: Responsible Conduct of Research (RCR) Training:

The responsible and ethical conduct of research (RCR) is critical for excellence, as well as public trust, in science and engineering. Consequently, education in RCR is considered essential in the preparation of future scientists and engineers.

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Goals: Instill in young research scientists that they practice the science with:

- ❖ a passion for truth, diligence, attention to detail
- ❖ a healthy measure of skepticism in the evaluation of experimental data, computational or analytical results
 - *check and recheck calculations for errors, devise tests of your assumptions*
- ❖ excellence in scientific methods, quantitative analysis, documenting procedures and data management
- ❖ excellence in communicating scientific results - writing & reviewing scientific papers

Responsibilities & Good Practices as in Authoring Scientific Papers

As a graduate student your research advisor will guide you through the process of writing research papers.

A few general guidelines:

The title, abstract and introduction are most important in conveying the main message of the paper, *so make sure:*

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- theoretical papers outline the fundamental equations and any assumptions that are made
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The end of the paper should summarize main conclusions and acknowledge research support, funding agencies and (only) relevant contributions from colleagues.

Example of the structure of a scientific report

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American Physical Society - Guidelines for Authors & Professional Conduct as Author and Peer Reviewer

Authorship standards

Authors of a scientific report should have contributed significantly to the concept, design, execution or interpretation of the research study.

Other individuals who have contributed to the study should be acknowledged, but not identified as authors.

The sources of financial support for the project should be disclosed.

Plagiarism constitutes unethical scientific behavior and is never acceptable. (check out plagiarism tools)

Proper acknowledgement of the work of others used in a research project must always be given.

Further, it is the obligation of each author to provide prompt retractions or corrections of errors in published works.

Responsibilities & Good Practices as Scientific Referee

American Physical Society - Guidelines for Authors & Professional Conduct as Author and Peer Reviewer

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- ❖ Your job is to help the authors and editor improve the paper if there are aspects that are unclear to you as an expert reader. Your job is NOT to re-write the paper or re-direct the research report.

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- ❖ Remember you are advising the Editor of the Journal, so
 - provide clear, succinct advice and keep your report to a reasonable length