Contest

# WHEEL: A Competition Report

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In the March issue of *Microscopy Today*, I perpetrated a trick on the reader. I proposed a new way to operate a transmission electron microscope, claiming that it would achieve an order of magnitude improvement in resolution—knowing that the idea would not work. A prize was offered (in a "Note Added in Proof," separate from the main article) for the best explanation as to why it would not work. Only one entry for the competition was submitted, and that was not—as far as I can tell—a serious attempt to show why the proposal would not work.

It seems that not enough people took me sufficiently seriously. So let me say quite clearly: everything in the article was correct. The logic of the WHEEL proposal is quite sound, and the use of the references is legitimate. There is no misrepresentation of the ideas. WHEEL would work except for one small flaw in the argument. In case you did not try to see what was wrong with WHEEL, because you thought the whole thing was nonsense, I will give separately my explanation as to why WHEEL does not work. If you choose, you can go back to the March issue and take another look, and try to see what is wrong, before you look up my answer (below).

Peter Ingram (who submitted the sole entry) is declared the winner (see below). He has stated that the prize (a free registration to a future Microscopy and Microanalysis meeting) will be donated to a "worthy student."

## An Additional Explanatory Note Regarding the Reference to Judith Reiffel

Many years ago, before computers, one of the major jobs of secretaries in academic work was the typing of scientific papers, which had been written out long-hand with a pen by the scientists. We scientists did not know how to type in those days. One such secretary, who had typed a very large number of these papers, said to herself, "I could do that." So she wrote a paper and submitted it for publication, and it got published [1]. The content of the paper was utter nonsense, but it had been written with just the right style so that no one noticed before it was in the proceedings of the conference. The organizers of the conference, the Electron Microscopy Society of America, were very upset, but I thought it a tremendous wheeze and was absolutely delighted.

The person who did this was Judith Reiffel who later became the secretary to *Ultramicroscopy*. As far as I can recall I never met Judith, but she became an important part of my life. Her communications from *Ultramicroscopy* were quite unique. Do you know about the pigs? Before computers and emoticons, she had a rubber stamp of a little dancing pig that would adorn her letters below the signature.

When Judith died, *Ultramicroscopy* published an extensive "In Memoriam" notice [2]. How usual is it that a scientific journal pays such a tribute to one of its secretaries?

So my aim in preparing WHEEL was, in part, just to make a rather silly, teasing joke and, in part, to add my tribute to Judith who did so much to lift all our spirits. The whole thing was what, in England, we call a shaggy-dog story—a rather long and elaborate set up for a rather unfunny punch line. I wanted to write an article that, on first glance or on casual reading, would seem to be a genuine and exciting publication but that would not stand up to scrutiny. Incidentally, after I had invented the "new technique" on which to hang the publication, I realized that it is not as obvious as one might suppose that the technique would not work. Hence the contest.

## References

[1] L Gandolfi and J Reiffel, *Proceedings of the Thirty-second Annual Meeting: Electron Microscopy Society of America* (1974) 552–53.

[2] E Zeitler, *Ultramicroscopy* 100 (2004) vii–ix.

# The Un-reinvented WHEEL

**Alwyn Eades**

The WHEEL proposal made in the March issue would work (I am firmly convinced) if only atoms in a solid were stationary. However, we know that (even at a temperature of absolute zero) the atoms in a solid are vibrating at very high frequencies. The wave field below the thin film that introduces the phase shifts will, at any instant, contain the singular caustic peaks described. However, at the next instant, because of the motion of the atoms, the singularities will disappear. Other singularities will appear in different positions (different laterally and also in different planes along the *z*-axis). Therefore, in the scanned image the signal would effectively come from random places (or none), and no high-resolution imaging would be possible.

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## Winning Entry: Reinventing the WHEEL

Dear Sir,

The purpose of this letter is not to explain the so-called "fraud" claimed in the paper by Morris et al. [1] but to praise it. It is in fact a very clever double bluff and is nothing short of brilliant! We don't feel the need for a new detailed explanation of why the technique *cannot* work—because it obviously does.

To be brief, the authors have eminently succeeded in disproving Heisenberg's Principle [2]—basically "the harder you try, the more difficult it gets" (this is mainly for the benefit of the many lay people whom we know read *Microscopy Today*); in fact if one extends this *ad absurdum*, it's impossible. We hasten to point out that Heisenberg himself tried to build such a microscope to refute his own theory (see Figures 1 and 2)—and failed miserably! Karl Popper [3] also made an impassioned argument that Heisenberg was wrong in his assertions, but he failed to recognize some basic elements of physics in his critique on account of the no-cloning theorem. To clarify, and paraphrase, a very good recent article in Wikipedia [4], cloning of a single quantum state is unnecessary; you just run the experiment like you normally would; that is, prepare multiple states by down-conversion and collect data on the receiver end from the large number of wavefronts.* The only difference, as alluded to above, is that you cannot employ a coincidence circuit in using the device for communication. So a large amount of noise will have to be filtered out somehow. One could conceivably have the receiver collect data in coincidence (or "semi-coincidence") if a three-wavefront Greenberger-Horne-Zeilinger state [5] is used. A third particle could be sent to the receiver, and waves there collected only in coincidence. Then the only noise will not be from singles, but rather receiver-only doubles. It has long been held that quantum theory is full of holes. Not only have the authors reinvented the WHEEL, they have created a whole new wheel.

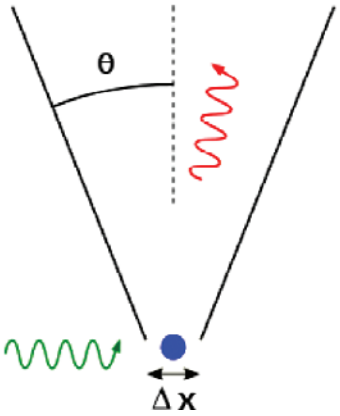


**Figure 1:** Heisenberg's microscope—a schematic diagram to illustrate the principle (through the courtesy and convenience of http://en.wikipedia.org/wiki/Heisenberg_uncertainty_principle). Green wave = electrons in; Red wave = electrons out; θ = angle of emittance; **x**: an infinitely small specimen.

We do not claim to be the first to make these observations; in fact the authors have unwittingly done it for us, for which we should all be most grateful. Perhaps in the future they should consider sticking to string theory—darn it!

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* It is now generally accepted that wavefronts and particles are usually interchangeable.

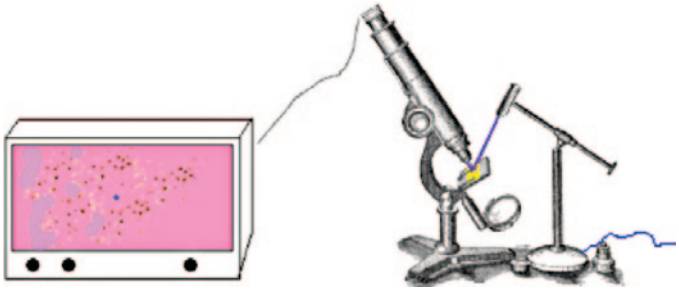

**Figure 2:** Heisenberg's microscope—a practical design of the instrument (through the courtesy and convenience of http://en.wikipedia.org/wiki/Heisenberg%27s_microscope).

## References

[1] WG Morris, S Madras and A Eades, *Microscopy Today* 18 (2010) 38–40.
[2] W Heisenberg, *Zeitschrift für Physik* 43 (1927) S. 172–198.
[3] K Popper, *Quantum Theory and the Schism in Physics*, Hutchinson, London, 1982.
[4] http://en.wikipedia.org/wiki/Popper%27s_experiment, the English Wikipedia entry "Popper's experiment."
[5] http://arxiv.org/abs/0712.0921, Cornell University Library online article "Going Beyond Bell's Theorem."

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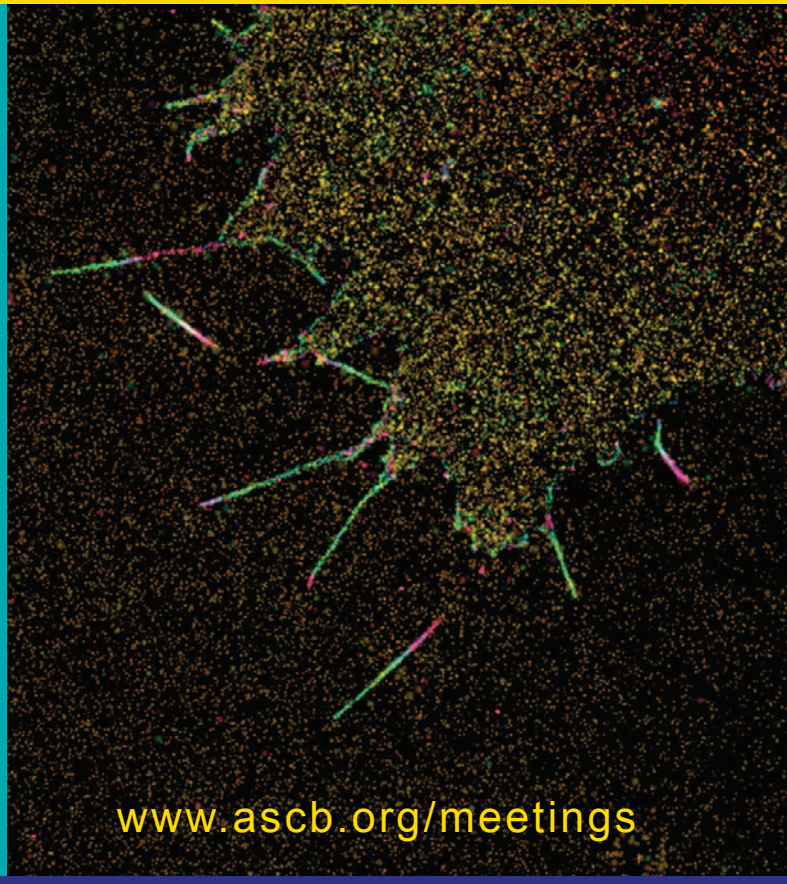

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