Klaus Staubermann, *Astronomers at Work: A Study of the Replicability of 19th Century Astronomical Practice* (*Acta Historica Astronomiae*, vol 32), (Frankfurt am Main: Verlag Harri Deutsch, 2007)

[manuscript version of a review to appear in *Journal for the history of astronomy*.]

"Because instruments determine what can be done, they also determine to some extent what can be thought", the introductory essay of one influential collection of studies boldly stated in 1994.[1] There has been a material turn in history of science, as some historians have become interested in the role of instrumentation and lab practice. As a result, we have a better grasp on the practical side of history of science, but much work remains to be done in this field.

This literature has different schools; one actually *use* the instruments: why settle for scrutinizing archives and libraries for clues as to how scientists historically went about producing knowledge with their instruments, when you can build and try to use your own version of Wilson's cloud chamber, Secchi's spectroscope or Boyle's airpump? Such use gives insights to the historian, claims Staubermann, who in this interesting work discuss his replication and use of several astronomical instruments from the 19th century.

While two other technologies are briefly discussed, the Steinheil drawing board and Oswald Lohse's astrophotography, the focal point of the book is Karl Friedrich Zöllner's photometer. Zöllner could be taken to exemplify what Peter Galison and others have described as the semi-autonomous identities of physicists working in instrumentation, experimentation and theory. Certainly not a theorist and not really interested in making a lot of accurate measurements either, as Staubermann clearly shows, Zöllner's skills and interests lay more in constructing instruments, often related to colours in one way or the other. Zöllner's father worked in the dye industry and, contextualizing Zöllner, Staubermann places one origin of Zöllner's and other scientists' interest in measuring colours in such a structural factor as the rapid development of the dye industry.

Zöllner's photometer reached widespread use in the second half of the century and Staubermann has reconstructed it and also used it for astronomical photometry. This, the main part of the book, is interesting and enlightening; it gives an account not only of Zöllner but also of the author's ethnographical approach to 19th century astronomy as he relates how he coped with gas light sources flickering in the wind, the problem of handling delicate equipment and moving about in the dark of night, and the frustration of clear skies clouding over again and again (the

observations in the book were done in Cambridge). Before I became a historian of science, I used to be an amateur astronomer so some of this was familiar ground, but it nevertheless made for good reading; one wonders if more historians will take up this kind of practices to gain insight into the skills and hardships connected with the craft of astronomical observation.

However, the book does raise some questions. It does not mention Hearnshaw's very useful history of astronomical photometry. Also, did Zöllner's photometer really become "so well established in preference to visual brightness estimations" as the author claims (p. 51)? Just one example to complicate this picture: of the 508 known observations of S And 1885, 17 were made with Zöllner-type photometers, 37 with wedge photometers and 454 were made without photometers using visual comparisons.[2]

To provide some practical context to his interesting work on Zöllner photometry, Staubermann could have pursued a photometric programme using Argelander's step estimate method as well, for insights into the choice of weapons available to the 19th century astronomer. And the discussion on photography could be more detailed. The introduction of photography lead to widespread discussion among astronomers at the time about the photographic magnitude scale and how this related to visual magnitude measurements, and extracting information from the photographic plates was a practice in itself that called for skills, management and a process of learning. We also do not see much of the intense work going on in parts of the astronomical community during the 1870's and 1880's about photographic techniques, a work that entailed thorough experimentation by astronomers and also communications between them; figuring out which recipes for developers gave the best results was not a trivial thing but rather the outcome of a process of astronomical practice and communication.

The work behind this book was done with great skill and belongs to a stimulating part of the history of science; it opens up fields for further enquiry.

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[1] Albert Van Helden and Thomas L. Hankins, "Introduction: Instruments in the History of Science," in *Instruments*, Osiris 9, 1994.

[2] G. de Vaucouleurs and H. G. Corwin, "S Andromedae 1885 - A centennial review," *Astrophysical Journal* 295 (August 1, 1985): 287-304.