Observing and Cataloguing Nebulae and Star Clusters:
From Herschel to Dreyer's New General Catalogue
Wolfgang Steinicke, (2010, Cambridge Univ. Pr.)

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review for *Metascience* by Woodruff T. Sullivan, III (Univ. of Washington)

Astronomy underwent profound changes in the century following the late 18th century, when William Herschel called attention to the sidereal universe outside of our solar system. Herschel catalogued 2400 nebulae and star clusters (and later his son John added 1600 more) and developed revolutionary schemes as to how these nebulae changed over time under the influence of gravity. Although most nineteenth-century astronomers were not interested in this type of research, a minority blazed trails that eventually led in the 1920s to the modern universe of galaxies as understood today. Along the way, one particular 1888 catalogue of nebulae and star clusters was of particular importance and in fact is still used today in the form of the familiar "NGC numbers" designating the brightest galaxies and clusters. In this book Wolfgang Steinicke, a lifelong amateur astronomer in Germany, has chosen to root out (and tell us) every fact he can find about the pre-history of every entry in this New General Catalogue compiled by the Danish-Irish astronomer J. L. E. Dreyer.

The book is an amazingly complex and detailed compilation of facts about observations of nebulae in the 19th century, but it has many fundamental flaws. In the first place, there is unfortunately very little historical sensibility or analysis. History is not merely a recitation of past facts, almost all judged according to modern technical standards. Consider a typical passage such as:

> "John Herschel entered these two objects as h 1274 and h 1275 in the Slough catalogue; h 1275, which is the brighter component NGC 4438 (10.0 mag), was identified as I 28. But h 1274 was equated with M 86 – a serious error, which was first noticed by Auwers and eventually corrected by John Herschel in the GC, which gives GC 2991 = h 1274 = I 28,1 and GC 2994 = h 1275 = I 28,2. M86 is now correctly identified as h 1253 = GC 2961." (p. 47)

If you have a need for this sort of detail (and a few historians and astronomers do), this book may be for you. But this passage also illustrates two of the ahistorical aspects of this book. When the author says "(10.0 mag)," does he mean as measured by Herschel or by someone much later? My guess is the latter – but we do not know without an investigation, and indeed why is this value

mentioned at all? And what does he mean by "now" in the last sentence? In 2010? At the time of Auwers? In Herschel's GC? And who decided the "correctness" referred to?

Another aspect of the lack of historical sensibility is that almost every past observation is immediately judged as being correct or not according to our current astronomical knowledge. An example (p. 35) occurs in the discussion of William Herschel's category called "planetary nebulae,"where the text says "[in this category] besides true (physical) planetary nebulae…there are many 'foreign bodies'." What does "true" mean here, and why the parenthetical word "physical"? "And "foreign" to whom? Another example of the 21st century intruding into the past: the sky coordinates in an early table (p. 26) are actually for epoch 2000.0 (but not stated), which is not at all relevant (and in fact wrong for the purpose of the table) to the 200-years-prior observations of Herschel under discussion. Also symptomatic of the confusion of present and past is the author's frequent practice of switching tenses in a muddled way, and of displaying modern images of the nebulae under discussion.

The organization of the book is superb, and 31 pages of extensive indexes (besides the list of 1600 cited publications) make it a joy to use as a reference book. One can be sent to the right page (there are 648 pages containing 239 Tables and 324 Figures) knowing any of the following: subject matter, name of object in the sky, observatory, telescope, or person's name. Once at the correct page, one finds numbers and dates and facts that are potentially useful fodder for any historian interested in astronomy during the century following 1780. Yet my perusal of the opening chapters unfortunately revealed enough errors of various types that one must be cautious before accepting any one of them.

This volume is a translation of Steinicke's 2009 Ph.D. dissertation at Hamburg University, and unfortunately the resultant English wording is often awkward, incorrect or confusing – Cambridge University Press certainly had a daunting task in copy-editing a book such as this, but in the end the final product is not up to their usual excellent standards. There are many typographical errors throughout, and in many instances, more seriously, the translation is faulty. Two examples where meaning is affected in a substantive way: "categorized by distance" should be "categorized by separation" (p. 44), and "catalogue was also reprinted in…" should be "catalogue was incorporated into…" (p. 49).

Amidst all of these problems, Steinicke occasionally delivers some nice analysis. For example, he shows statistically how William Herschel's qualitative brightnesses of nebulae are only weakly correlated with modern measurements. He ferrets out all of the times that Herschel mistakenly catalogued a nebula twice, reducing his published 2500 entries to 2438 actual objects in the sky. He also demonstrates how it was actually John Herschel, not his father, who associated the

planet Uranus with his father's category of "planetary nebulae." For the late 19th century, he follows over decades the enigmatic cases of (a) Hind's variable nebula (NGC 1555) (was it indeed varying?), and (b) the morphology of Messier 51 (NGC 5194), the first nebula known to have spiral structure, as first recognized by Lord Rosse in 1845. Finally, his short biographies and portrait photographs of the protagonists (and often their telescopes) who contributed to the eventual NGC are very nice to see. But Steinicke is obsessed with statistics characterizing each of these astronomers, usually ranking the success of each man solely by the total number of nebulae bagged, seldom by other criteria. He refers to "top scorers" much as one would for a baseball or football team.

So who should buy this book? I recommend it to any person who (1) has the considerable funds to purchase it, (2) is fascinated by technical detail that usually serves no historical purpose, and (3) wants a reference book, but realizes that any statement of importance to him or her found in the book must be first checked in the cited primary sources.