A Practical Guide to Lightcurve Photometry and Analysis

Brian D. Warner

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Foreword by Alan W. Harris

Springer

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Foreword

It is a pleasure and an honor to offer a few words of forward to Brian Warner's guide to photometry. In his preface, he makes a considerable point about amateurs and professionals, and those who dare or deign to step across the line supposedly dividing the two. Here I would like to make a few observations about the two monikers, and suggest that there is not, or at least should not be, a distinction between "amateur" and "professional." In preparing these remarks I referred to *Webster's New Collegiate Dictionary* (1960 edition; not so new anymore, but that was when my collegiate experience began):

> **am´a·teur**, *n*. [F., fr. L. *amator* lover, fr. *amare* to love.] 1. One who cultivates a particular pursuit, study, or science, from taste, without pursuing it professionally; also, a dabbler. 2. In sports and esp. athletics, one who is not rated as a professional.

Well... a "dabbler" eh? "not rated as a professional"? No wonder we have an identity problem here. Somehow in my youth as an amateur astronomer I missed this connotation of the term. To me, the meaning of the term amateur was dominated by its root, "to love," that is, one who does what he does out of love of the subject, not for remuneration (to the extent one can get away with that). In that context, most "professional" astronomers I know are also "amateurs": they love what they are doing and choose the profession primarily for that reason, not how much money they could earn. Indeed, I have often advised students that if they are smart enough to eke out a living in astronomy they are smart enough to get rich quick in some other field, thereby freeing themselves a bit later in life to become a "gentleman astronomer."

This brings me to another perspective on "amateur" versus "professional." Most folks need to earn a living somehow, so almost every "amateur" astronomer is a "professional" at something else. And curiously, most of us who call ourselves "professional" astronomers are amateurs in other fields that are essential to our pursuits. This basic fact of life further blurs the distinction between amateur and professional, in any field. Indeed, my own graduate training is as a theoretician. I have never taken a single course in observational astronomy. So as an observer, I'm one of you, an amateur, self-taught in my own backyard. Another conspicuous example is computer programming. "The other Brian Warner," author of this book, is a professional when it comes to software development, and writing for that matter, talents many of my "professional" astronomer colleagues sorely lack. A result of this is that there are software packages out there, written by professional software writers for the amateur community that are far more powerful, efficient

and user-friendly than their "pro" counterparts. The people who wrote them may be "amateur" astronomers, but they are highly professional in their computer skills. Amateurs now have at their disposal computer tools for telescope pointing, focusing, data taking, and reduction that far surpass what is in use at most professional observatories. You'll find several such packages mentioned and described in this book.

I'll now turn to a bit of history. In the late 1990's, my colleague Ted Bowell and I noted that there was a dearth of activity among American amateur astronomers in minor planet (asteroid) observing, compared to various overseas observers, notably in Japan and Italy. Ted had just been to an amateur meeting in Italy and was favorably impressed by their organization and activities. We decided to organize a meeting of amateurs and professionals engaged in asteroid observations to try to stimulate interest in the amateur community in the United States. The meeting was hosted at Lowell Observatory in Flagstaff, AZ, 23–24 April, 1999. I think we were successful in stimulating interest.

During the meeting, it became apparent, to me at least, that a key to amateur participation was the availability of understandable and user-friendly computer tools. At that time, amateur participation in asteroid work was mainly in astrometry, aided by the program *Astrometrica*, written by Herbert Raab of Linz, Austria. This program allowed amateurs to do positional astrometry on asteroids in a friendly environment without having to understand fully every detail of the process (*n.b.*, this is not the same as "in a state of ignorance"!). At the time of the Flagstaff meeting, I commented that in order to get amateurs involved in photometric observations of asteroids, what was needed was a *Photometrica* program.

In the years since that time, *Photometrica*, admittedly not by that name, has been written, in fact in several versions, as cited in this book. One is Warner's own *Canopus* program, and this book serves as a companion for observers who want to learn the game of asteroid or variable star photometry, using either *Canopus* or one of the several other options mentioned in the book. I think with the development of these user-friendly programs, and now with the publication of this book, CCD (charge–coupled device) photometry for amateurs has come of age, and I look forward to the contributions that will inevitably follow.

Alan W. Harris*
La Canada, CA
August 2003

*There is also another Alan Harris (also engaged in asteroid research, in Berlin, Germany). In this case we are both Alan William Harris, so a middle initial doesn't differentiate. I refuse to identify him as "the other" Alan Harris, as I think neither should suffer a diminutive term. The same goes for Brian Warner.

Preface

Pardon the "D" in the author's name on the cover (it stands for "Dale" by the way). I'm the *other* Brian Warner. The *real* Brian Warner is the famous and distinguished one. He's the author of *High Speed Photometry* and *Cataclysmic Variable Stars*. There yet is another Brian Warner. He goes by the stage name of Marilyn Manson. I've received some very strange phone calls late at night from some of Manson's fans. "No, I'm the *other* Brian Warner." The disappointment at the other end was nearly devastating. So, I use the "D" to make sure it's clear who I am and so that you won't think I'll break out into song at any moment.

The real Brian Warner and I do have something more in common than our names: a deep interest in lightcurves. My interest is not so much in cataclysmic variables but asteroids and eclipsing binaries. When I was in junior high school, I had hopes of being a professional astronomer someday and specializing in close contact binaries. Many years have passed and I'm not a professional astronomer. However, I do still occasionally observe eclipsing binaries as a nearly full-time "gentleman astronomer."

My first efforts in asteroid lightcurves began in the 1970s when I worked with the late Terry Schmidt at his Tiara Observatory in South Park, CO (yes — *the* South Park). It was my great fortune to leave my small telescope out on the porch on a day he was walking around the new neighborhood. He spotted the scope and knocked on the door. That started a 25-year friendship with Terry as my astronomy mentor. One of my three asteroid discoveries, 34398 Terryschmidt, is named in his honor.

I was pleasantly surprised at the popularity of the first edition of the *Practical Guide*, and so I want thank everyone, the reviewers especially, who embraced the book. As with any book on a complex topic meant for the reader with a beginner to intermediate technical understanding of the topic, the first edition covered some things in less detail than it might have and certainly left many things out. That's what second editions are for: to keep the material fresh, fill in gaps from the first edition, and tell of new ways to approach old problems. These are goals for this second edition in addition to, of course, being a recruiting tool to bring more people into the exciting field of photometry and lightcurve analysis.

Since the first edition, I've developed and learned of what I believe are easier and more straightforward methods for reducing data, the process that is probably the biggest "monster" the beginning photometrists encounters, or at least fears. Those methods are presented in this second edition in lieu of those from the first. I could include both sets but that would increase the size of the book beyond what the editors would allow and, more important, would serve more to confuse than help the reader. The original methods follow those described in other well-known

texts such as Arne Henden and Ron Kaitchuck's *Astronomical Photometry*, which should be on the shelf of any photometrist, no matter what level.

Along with changes in the reduction methods come those to the observing guidelines. The second edition has streamlined those so that you can go to the telescope with a much clearer game plan and so concentrate more on getting data of your target than on wondering if you're doing the right thing in the right way. You'll still find information about analyzing lightcurves, asteroid and eclipsing binary – after all, the title does include "Analysis."

You'll also get some more insight about measuring images; in particular, how aperture sizes affect data. When trying to reach a higher level of work, you need to understand some of the finer details – without necessarily having to know the math or hard theory involved – so that you can use your software to the best of its ability. As I noted in the first edition, never trust a computer. Just because it gives you an answer doesn't mean you shouldn't question it. The more you know about what's involved in getting good data, the better a scientist you will be.

I'll keep this brief, so before I conclude, I want to thank Alan Harris, Arne Henden, Richard Binzel, and Petr Pravec again for their continuing support. I also want to thank Robert Buchheim and Richard Miles. Both have contributed enormously to my understanding of photometry's "dark side" and alternate methods. Their knowledge and generosity made this second edition far more complete than it might have been otherwise.

A number of people read the revised manuscript, trying to make sure that the material was both clear and accurate. They were Richard Binzel, Robert Buchheim, Robert Stephens, Robert Koff, Jerry Foote, and Greg Crawford. My thanks to them for finding the glaring errors. Any that remain are solely my responsibility.

Thanks to John Watson of Springer for taking the proposal for a second edition to the editorial board for its approval as well as his suggestions. Thanks also to Dr. Harry Bloom and Christopher Coughlin, also of Springer, for taking on the task of dealing with a writer who was forever the frustration of his English teachers. Without them, there would have been no second edition.

This one's for Margaret, too.

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July 2005

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