

1.0 Introduction

As a photographer and someone who was infatuated with all things space related it seemed natural that I would put the two together. After all, I grew up in the great space era spanning from the Apollo programs through Skylab, Mir, the shuttles and now with the ISS and private space carriers.

My father was quite an active private pilot and I learned to fly before I could see over the dash. The skies are beautiful over the countryside at ten thousand feet.

The first experience with real astronomy was with a horribly under mounted EQ reflector that I managed to buy one year after working more holiday hours than any sane person ever should. This was back in the pre-internet days and in a small town for someone who had to work three solid days during Thanksgiving just to afford a \$300 telescope there were not a lot of places to turn for help. And so I hated that scope, not because it didn't work, but because I could never learn to use it. Fortunately, it still survives and gets used with a good friend and his three small children.

It wasn't until later in life that I finally acquired the means and time to actually pursue amateur astronomy as anything more than occasionally looking up at the sky with wonder and frustration. Finally I thought I could do something with this! What's more, I had the photography equipment that should allow me to not only look at objects, but capture them. Then I realized something horrible, the information on astrophotography I could find was sparse, outdated and incomplete from a beginner's point of view.

I read several books, searched the internet and poured over online forums. Nowhere was there a really good starter's guide on serious astrophotography. Sure, there were some good books but they mainly focused on a brief overview of the ideas coupled with tutorials on a specific piece of software that I had never heard of and couldn't find anyone who actually used it. What I wanted, what I really needed, was something that covered pretty much all the theory and most of the practical application all in one place.

Still, I pushed ahead, determined to make a go of it. It was at this time that an astronomy club of which I was a member asked me to speak at their beginner's meeting. I was flabbergasted. Why would anyone in their right mind want someone who has been doing this all of four months to speak at their meeting? Then it hit me, because I had only been doing this four months I had a very unique perspective.

The problem was I hadn't really thought about it, but I still gave it my best shot. I cobbled together the foundation of what would eventually become this book, approximately

nineteen pages of notes and scribbles of how I made things work. Unfortunately I had little time to prepare what I would say, and spent most of that time working on the paper and some prints to mount and show, so my speaking left a lot to be desired. I recorded the whole thing so I could go back and laugh at myself, which I still do.

This book is an attempt to rectify all the problems I found when I started down the path.

Before we begin I feel it is only right to thank a few people. First and foremost is of course my wife Sue Ann. Without her understanding and support none of this would have been possible. Mike Prokosch for making sure I could always get in to the observatory. Don Taylor for answering a never-ending stream of questions at the observatory all night long, for more nights than he probably cares to remember. The Sam Houston State University Physics Department for sharing their fine facility with the local amateur astronomy organizations. The sales and service team at Orion Telescopes for helping me get the exactly correct setup for what I wanted to do and for helping me iron out the kinks. Tom Field from R-Spec for his unbelievable support in spectroscopy. George Marsden from the North Houston Astronomy Club for asking me to speak at the Novice Session which started all this writing mess (By the way George, my wife knows you are to blame for all the time I spent writing this, and for making her read it over, and over, and over. Don't open any packages from her 😊). And far too many more people to mention. Thank you all.

1.1 About this book

When I decided to write this book I wanted something written from the point of view of the beginner, answering what seems like the stupid questions right up front. I wanted to start with the very basics to get you up to where you can participate quickly, then expose you to some of the more advanced techniques to give you room to grow. Hopefully this book will also help answer the “why’s” and “how’s” that I never seemed to understand.

I have written this book in short, digestible sections in a logical progression from what you need to know before buying anything, to the basics of how to set it up and use it, through more advanced methods. I hope that it will give you enough information on enough topics to get you going and keep you interested.

This book also contains a wealth of pictures, graphics and charts to show you, instead of just tell you, what it is we are talking about.

I have not tried to be the best at everything, there are for example better books on image processing with specific applications. This book is more about overviews and understanding what and why you want to do things rather than exactly how to do it in a specific application. In some areas I have tried to show you how to do something in more than one program so you learn the ideas and not just how to work one program.

This book could go on indefinitely, or at least I can’t see an end. What is here is where I just decided enough was enough. My goal was to give you enough information to keep you going and get you over the beginner’s hump, to where you could not only ask intelligent questions but understand the answers once you got them. A base you could draw on to start to figure out the more complex issues on your own.

So what exactly is long exposure astrophotography? Normally this is considered exposures longer than thirty seconds at a very far away and dim object such as a nebula (brightly colored gas cloud in space). All those really cool Hubble telescope images are in this category.

Why should I take long exposures instead of short exposures? Simply put, short exposure AP work is a field all its own and can create some spectacular images. Unfortunately it cannot image the same extremely faint objects that long exposure can, even if you stack hundreds of images together (more on stacking later).

Let’s start by scaring the heck out of you, long exposure astrophotography typically starts with at least \$2000 (assuming you already have a camera) and can have you out in the

freezing cold dead of night for 8+ hours dripping wet from dew to get one little picture that some people won't believe you took anyway. If that freaks you out this may not be the hobby for you.

Now that is not to say that you cannot do any astrophotography unless you have lots of money, it completely depends on what you want to get out of it. This book is written with an aim at the middle of the road so to speak. I assume you have enough money to buy a setup that will track a target accurately for ten minutes. I do not assume you have enough money to buy a \$10,000 research grade mount. Even if you are starting with a poor starving student's bank account balance, you can still get a lot of information from this book to help you understand your limitations, what you can do, and where you may want to go in the future.

Still with me? Then let's move on!

Let take a moment to point out that most of what is in this book is what that worked for me. Asking lots of questions and reading lots of books is a great start, but eventually you need to get out there and test things to see how they work for you. What I am sharing is mostly what I got out and tried.

Astrophotography and other forms of photography have much in common. Both can be done by anyone with enough money for a body/lens or body/telescope combination, and both can be improved with the right skills and right equipment.

With either type of photography you have to ask yourself what you want to accomplish before you just jump in. There are many different levels and tons of different specializations you can master. The bulk of people I hear talking about wanting to do astrophotography want to do a few things including the moon, Jupiter, Saturn, the Orion nebula, the Horsehead nebula, and a few other galaxies and nebulas to show their friends and impress their family. This does not require a huge investment and can to some degree be done with just a few hundred dollars. The key is information.

One of the fantastic things about this hobby is how far you can push it. Once you get the bright Messier objects done there are the Caldwell objects, then the Herschel objects, then thousands of NGC targets. From there you have tons of other lists: splitting binary stars, stellar spectroscopy, measuring variable stars and the list just goes on and on. While all this is going on you are constantly refining and improving your capturing and processing abilities and so reimaging targets to make the images even better.

All of this can span many lifetimes so it is very unlikely you will ever run out of things to do 😊

Every astrophotography image on and in this book was done by myself, with the equipment recommended by and shown in this book. The cameras, scopes, mounts and accessories you see pictures of throughout the pages are mostly what I use.

NEVER EVER EVER POINT ANYTHING TOWARDS THE SUN WITHOUT THE CORRECT PROTECTION. NOT YOUR EYES, NOT BINOCULARS, AND CERTAINLY NOT YOUR TELESCOPE. FAILING TO HEED THIS WARNING COULD LEAD TO PERMANENT BLINDNESS, EQUIPMENT DAMAGE, OR FIRES (AND FIRES CAN LEAD TO PROPERTY DAMAGE, BODILY INJURY, AND EVEN DEATH). NO NO NO, BAD BAD BAD

