Astronomer's Pocket Field Guide

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Observing the Sun

A Pocket Field Guide

Springer

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Preface

There are many books on today's market that cover what is undoubtedly the most energetic body in our solar system, the Sun. Many of these titles are a great read, and answer a number of the questions asked by observers regarding this truly dynamic subject. These are books which make excellent additions to any observer's library as they target the armchair astronomer, one who enjoys reading on an overcast day.

That said, this book has a different resolve. The aim here is to provide you with a source that can be taken to the observing field, and when needed referred to at the telescope. It will fit conveniently in a pocket for easy access, or in a box of accessories, hence the compact size. When I was first approached with the idea of producing a field guide for the Sun, a light bulb immediately lit over my head. The concept of a pocket-sized guide for the solar observer was admirable. As far as I knew, this had never effectively been done before.

Because the Sun is an object in constant flux, astronomers rarely know for certain what awaits them at the telescope. All solar features are transient, sometimes fleeting, and the life cycles of most tend to be somewhat elaborate; in those cases, classification schemes become intricate. Take for instance sunspots, which begin as pores in the photosphere. Most decay but others sometimes continue development, growing in girth, strength, and numbers. These specimens in turn sprout penumbra and conceivably can become monstrous complex blemishes on the solar face. Spots develop into a variety of types.

Committing the stages of a life cycle of such features to memory can be a daunting challenge. Other times, an observer asks, "What type of prominence am I viewing, and why is it so bright?" This book is designed to help answer such questions, and many more. The amateur solar astronomer is in need of a comprehensive guide to identify features, one that is intended for use in the field.

As a consequence, I have written *Observing the Sun: A Pocket Field Guide*.

The book is divided into two distinct components to facilitate its use. Part One focuses closely on the Sun and its features, while observational techniques are discussed in Part Two. You will not have to search exhaustively for information about white light features, chromospheric activities, or the solar corona. That information is organized into separate sections within appropriate pages. Each piece, examining the photosphere, lower and upper chromosphere, and the corona, opens with a keyed whole disc image pointing out significant phenomena. Then the following pages contain descriptive text, many times accompanied by close-up illustrations depicting the discussed feature.

To effectively use this field guide at the telescope, begin by reading the material ahead of time, and become acquainted with solar features before ever placing your eye to the telescope. You should possess a general idea of what to expect when you observe the Sun, or even the most obvious structures will escape you. This is called *developing your observing eye*.

Next, decide what part of the Sun to observe. By part I don't mean location on the disc, but rather what layer. Solar observing is viewing the Sun's atmosphere. The atmosphere of the Sun is divided into several unique layers that are best seen by an amateur solar astronomer using three different wavelengths of light. The lowest atmospheric layer is the photosphere often erroneously, but acceptably, called the surface. The photosphere only appears surface-like because of its opacity. The other layers above the photosphere include the chromosphere, which will be divided into its lower and upper regions, and lastly the corona. The heart of this book has four sections each dedicated to one of the layers. These sections are presented progressively as they exist on the Sun from the photosphere outward.

Discerning the photosphere is done by observing in the solar continuum, commonly called white light. We see the region just above the photosphere (lower chromosphere) in the light of calcium, using Ca-K appliances and the upper regions of the chromosphere best with H-alpha viewing appliances. The fourth layer, the solar corona, is visible to an amateur astronomer only during a total solar eclipse, once more best in white light.

Depending on the layer being observed, identify the corresponding section of the field guide to be referenced. Features within their respective section are organized in a pattern of observability and development. For instance, the photosphere section begins with simple naked-eye observations and progresses to granulation, faculae, pores, and then the most recognizable feature, sunspots. A similar progression is found in the other sections.

The illustrations accompanying the dialogue will prove invaluable for identification at the telescope. An excellent example is found with the Roel image attending the pores and voids commentary. A pore does not significantly appear different from dark granular material. With an illustration handy, no doubt remains as to which is a pore and which is not.

This book is more than an illustrated guide to solar phenomena; within Part Two you'll find information on how to observe the Sun safely. With today's modern tools and a common sense approach, solar observing is a 100 % safe activity. Instruments for observing the Sun as well as explanations of solar directions, rotations, and numbering systems are covered. Knowing what to do with an observation is as important as knowing what you are seeing; therefore the second Part also guides the reader in simple steps for recording solar observations.

The book concludes with a thorough Appendix section composed of current organization websites, a glossary, blank recording forms, and Stonyhurst templates that can be photocopied for your record-keeping. An ephemeris of daily solar statistics is generously included containing the elements required for reduction of daily observations.

The Sun in my opinion *is* the most interesting object we have to study in the heavens. Some time ago, I conducted a not-so-scientific survey of online

friends to discover what they found fascinating about observing the Sun. Of course many responded relating to the sheer dynamics of the Sun, or the beauty and magnitude of the events happening there. Someone else stated humorously that, "the Sun is easy to find in the sky." And yet others declared, "It is simply fun to share views with the public."

Solar observing is indeed fun, but a word of CAUTION is always in order to prevent the novice from immediately rushing out and directing a telescope Sunward. The Sun emits huge quantities of heat, light, and radiation, which **must** be respected at all times. The greatest danger to the Earth-bound observer is in the brightness and IR/UV light of the Sun. These non-visible wavelengths must be blocked and the intensity of the solar illumination reduced significantly for safe studies to be conducted. Without these precautions, **blindness of the observer will result**. This topic is discussed in following pages. Regardless, the author and publisher cannot be held responsible for the careless action of any solar observer disregarding safety procedures. The rule of thumb regarding solar observing is to always err on the side of safety. Do that and you'll enjoy many years of viewing nature's most magnificent spectacle.

Homer, IL, USA Jamey L. Jenkins

Acknowledgments

This book owes its creation to the efforts of a number of individuals to whom I express my sincerest appreciation. First comes to mind, my dear friend from the past, the late Howard F. Zeh for his never failing encouragement and mentoring, without which my fledgling interest in amateur astronomy may never have bloomed into what has now become a lifelong hobby. Next would be Richard Hill of the Lunar and Planetary Laboratory, University of Arizona, who has provided the inspiration that led me to this project. Thanks for your support Rik!

Gratitude of an immeasurable amount goes to the army of observers stationed around the world who generously supplied their expert imagery of solar features. Without each photographer's effort this project would have been but a collection of words and thoughts. Their pictures tell the story so much plainer than I ever could articulate. Contributing solar photographers to this project include: Art Whipple, Eric Roel, Alexandra Hart, Christian Viladrich, Fabio Acquarone, Jim Ferreira, Thomas Ashcraft, Gordon Garcia, Steve Rismiller, and Dr. Neal Hurlburt of the Lockhead Martin Solar and Astrophysics Laboratory for the TRACE image.

Several contributors of graphic material or photos of their specialty equipment also need recognition. These include William Waller, Raymond Rienks, Greg Piepol, Robert Hess, and Dr. David Hathaway of NASA.

A special thank you to Brad Timerson of the Association of Lunar and Planetary Observers Solar Section for his computation of the Solar Ephemeris found in the Appendix of this book. Brad has *always* cheerfully come through with this vital information the several times I've requested data.

My family deserves the greatest indebtedness of all for their unconditional support during the many hours spent behind the keyboard focused on this venture. And to my wife Mary, thank you for believing in my desire to share solar astronomy with an interested readership.

And lastly, to those who have obtained a copy of this book. Without you the dissemination of information would have been futile and served no purpose. Enjoy astronomy, and in particular solar astronomy, where from your own backyard you may find delight in an intimate view of our nearest star, the Sun.

Homer, IL, USA Jamey L. Jenkins

About the Author

This is the second book written by Jamey Jenkins about the Sun. Springer published the first, *The Sun and How to Observe It*, in 2009 as a broad look at solar observing. That book took a wide-ranging approach, explaining to the amateur astronomer the how and why of studying the nearest star. This venture, *Observing the Sun: A Pocket Field Guide* is meant for decided use at the telescope with a specific focus on the Sun's abundant features.

A product of the space age during the heyday of the 1960s' Gemini and Apollo space programs, Jenkins' experimentation with a succession of increasingly larger telescopes led to developing several pen pal friendships and an invite to write for Dave Eicher's fledgling amateur journal, *Deep Sky Monthly*. As time passed, work and family responsibilities began assuming a priority and evening observing soon succumbed to the daytime study of sunspots and related solar phenomena.

Jenkins has contributed to the Sunspot Program of the American Association of Variable Star Observers (AAVSO) and is an active member of the Association of Lunar and Planetary Observers (ALPO) Solar Section. He's also served as Assistant Section Coordinator of that group for a number of years. Jenkins firmly believes that it is vital for one wishing to develop in this hobby to have a connection with other observers; a mentor is invaluable when it comes to understanding technical aspects.

These days, Jenkins photographs sunspots, watches calcium clouds, and studies prominence activity from his backyard observatory with a substantial 125 mm f/18 refractor. A significant development from the tiny Galilean lunar telescope of his past, this home-assembled telescope shows the Sun's unique character, as a seething, boiling cauldron of gas, and indeed the master of the solar system.

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