

Observing Variable Stars, Novae, and Supernovae

Variable stars can be fascinating objects to study. This complete practical guide and resource package instructs amateur astronomers in observing and monitoring variable stars and other objects of variable brightness. Descriptions of the objects are accompanied by explanations of the background astrophysics, providing readers with a real insight into what they are observing at the telescope. The main instrumental requirements for observing and estimating the brightness of objects by visual means and by CCD photometry are detailed, and there is advice on the selection of equipment. The book contains a CD-ROM packed with resources, including hundreds of light-curves and over 600 printable finder charts. Containing extensive practical advice, this comprehensive guide is an invaluable resource for amateur astronomers of all levels, from complete beginners to more advanced observers.

GERALD NORTH graduated in physics and astronomy. A former teacher, college lecturer, and Guest Observer at the Royal Greenwich Observatory he is now a freelance astronomer and author based in Norfolk, UK. He has been a member of the British Astronomical Association since 1977, and has served in many posts in the Lunar Section, in addition to contributing observations to various other sections. He has written numerous books, including the acclaimed *Advanced Amateur Astronomy*, and *Observing the Moon*, both published by Cambridge University Press.

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GERALD NORTH

(with accompanying CD-ROM by Nick James)



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Preface

Stand outside to enjoy the glittering spectacle of a particularly clear night sky and you will probably get a false sense that the heavens are unchanging and serene. True, most of the stars visible do shine steadily but many do not. Some of them vary their brightnesses very slowly, taking years or centuries for any change to become apparent. Others that change do so faster, taking months or even just days. Still others can significantly vary their outputs in a matter of minutes. Some even flicker (in the real sense – not just the scintillation of their images as seen through our Earth's unsteady atmosphere) in timescales as short as seconds. Fortunately for us our Sun is one of the more constant of the 200 billion stars that inhabit our great Galaxy.

Actually, all stars must vary their outputs at some time – certainly during their births and deaths if not during other phases of their lives. Many stars are wrecked by colossal explosions and others are significantly changed by violent outbursts.

Variability is not the sole province of the stars. Galaxies, and particularly the objects lurking within their centres, can be subject to significant changes which involve energies of incredible proportions.

Astronomers both amateur and professional have long been following the behaviour of the variable-brightness objects in our Universe but it has fallen on amateurs to do most of the long-term monitoring. In recent years technical advances in the equipment available to amateur astronomers have pushed back the faintness limit and increased precision in the measurements. Consequently amateurs can now undertake work that was at one time the sole province of the professionals. You have a great opportunity to take part in this ongoing research yourself.

This book is intended to be a 'primer' – a guide for the interested amateur astronomer who is yet to become a specialist in the field of observing and monitoring variable stars and other objects of variable brightness.

Preface

In the first four chapters I cover the practicalities of observing and determining the brightnesses of the *astrovariable* – the term I have coined for all types of variable-brightness object in the heavens – at intervals which will allow their brightness changes to be studied.

Chapter 5 lays the basis for a study of a wide selection of astrovariables, this occupying the remaining chapters of this book. In these chapters I explain the reasons behind the brightness variations (as far as we presently understand them) set into the context of the wider field of astronomy and astrophysics. I think you will find it a fascinating story. Along the way we will make use of the considerable resources my friend and colleague, Nick James, has placed on the CD-ROM which accompanies this book.

I hope that you will enjoy reading this book. Most of all, though, I hope that you will go out and use whatever equipment you can assemble to begin observing the variable heavens for yourself. If you do, I hope that the information and resources in this book and the accompanying CD-ROM will help you along the way. Good luck – and good observing!

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Figure 1.1 The constellation of Orion, photographed by the author. Of the main stars that form the familiar outline of this constellation, the upper-left one is the red giant star Betelgeuse. This semi-regular variable star is one of about thirty whose brightness variations can be followed with the naked eye.