The Complete Guide to Observing Lunar, Grazing and Asteroid Occultations

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Richard Nugent, Editor
An occultation (pronounced “Occ-kull-tae-shun”) occurs when the Moon, asteroid or other planetary body eclipses a star momentarily blocking its light. Occultation observations have been used for hundreds of years by sailors to determine time and their position at sea. Modern occultation observations are routinely used to refine the orbit of the Moon, analyze the positions of stars and the coordinate system they represent, detect new stellar companions, pinpoint the position of X-ray and radio sources, determine the size and shape of lunar mountains, determine the angular size of stars, and the recent hot area of determining the size and shape of asteroids in our solar system. In 1988, Pluto’s atmosphere was discovered by the occultation technique. In March 1977, the occultation of a bright star by the planet Uranus resulted in the discovery of its ring system. This ring system might actually have been seen indirectly by the discoverer of Uranus, William Herschel, as he noticed faint stars dim as the planet passed close by.

Occultation observations are fun to observe. There is perhaps nothing more exciting than watching a star vanish and return from behind a lunar mountain, or to see the star disappear for several seconds as an asteroid passes in front of it. Anyone with a small telescope, tape recorder or camcorder and shortwave radio can make valuable scientific observations to help determine the size and shape of asteroids and to aid in new discoveries about these mysterious objects, including some of the elusive small moons that orbit them.

This observer’s manual is the first comprehensive book of its kind to assist beginning observers get started in occultation observations. This manual also shows advanced observers the latest in video and GPS time insertion techniques. It is a How To guide in observing total and grazing occultations of the moon, asteroid occultations and solar eclipses. Whether you are an observer with a small telescope or an experienced observer with a video system, this book will show you how to set up your equipment, predict, observe, record, report and analyze occultation observations whether you are at a fixed site or have mobile capabilities.

The International Occultation Timing Association (IOTA) and its worldwide sister organizations (Europe, Australia/New Zealand, Japan, Asia/India, Mexico, South America) are here to assist you. We have online Internet discussion groups and observers are in contact with each other nearly every day planning for the next occultation expedition or sharing ideas on new equipment, software and new techniques. IOTA and several of its members have web pages loaded with occultation information and methods, tips, software, predictions and results of observations. The Internet has simplified occultation observations with predictions and results now online. Equipment advances (especially video) along with accurate star and asteroid positions have resulted in an explosion in occultation observations in the past ten years. Whereas between 1978 and 1998 less than 20 successful asteroid occultations were observed each year, now there are over 150 successful asteroid events observed worldwide annually by numerous teams of observers.

The novice occultation observer will find basics of occultations including how to observe and to record them accurately using simple, inexpensive equipment. Advanced observers will find video methods of recording occultations. This includes the use of the GPS satellites along with video time inserters that can provide frame by frame analysis of observations providing timings accurate to several hundredths of a second!
The potential for new discoveries continues with every new occultation observation. Astronomers, both professional and amateur, are encouraged to get involved in this exciting field and get in on the one of several online occultation discussion groups to see what events are likely to occur in their area. Information on how to get involved with IOTA and contact information is given in Appendix A, along with the many IOTA organizations worldwide.

Please join us.

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Executive Secretary  
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Acknowledgments

A project on occultations such as this is the product of decades of effort and work by the hundreds of worldwide occultation observers, expedition leaders, software originators, and many others. Without the dedicated efforts of these individuals, the modern occultation program would simply not exist. Dr. David Dunham is the founder and only President of IOTA/USA, leading the way in the occultation program in North America for over 45 years. Many pioneers have carved out the methods and techniques of occultation observing including: Hal Povenmire, Paul Maley, Dr. Wayne Warren Jr., Robert Sandy, Richard Wilds, Tom Campbell, Dr. Tom van Flandern, Steve Preston, Walter Morgan, Walt Robinson, Don Stockbauer (USA), Dr. David Herald (Australia) Edwin Goffin, Hans Bode, Eberheard Riedel, Gordon Taylor (Europe), Dr. Mitsuru Soma, Dr. Isao Sato (Japan) and numerous others.

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