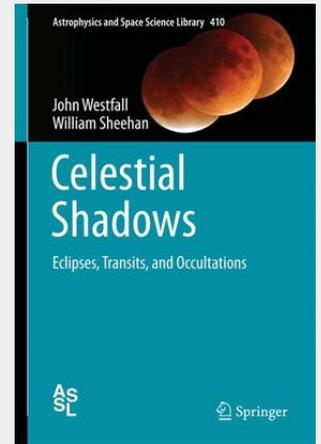


Celestial Shadows

Eclipses, Transits, and Occultations

Much of what is known about the universe came from the study of celestial shadows. This book looks in detail at the way eclipses and other celestial shadows have given us amazing insights into the nature of the objects in our solar system and how they are even helping us discover and analyze planets that orbit stars other than our Sun. A variety of eclipses, transits, and occultations of the moons of Jupiter and Saturn, Pluto and its satellite Charon, asteroids and stars have helped astronomers to work out their dimensions, structures, and shapes - even the existence of atmospheres and structures of exoplanets. Long before Columbus set out to reach the Far East by sailing West, the curved shadow of the Earth on the Moon during a lunar eclipse revealed that we inhabit a round world, a globe. More recently, comparisons of the sunlit and Earthlit parts of the Moon have been used to determine changes in the Earth's brightness as a way of monitoring possible effects in cloud coverage which may be related to global warming. Shadows were used by the Greek mathematician Eratosthenes to work out the first estimate of the circumference of the Earth, by Galileo to measure the heights of the lunar mountains and by eighteenth century astronomers to determine the scale of the Solar System itself. Some of the rarest and most wonderful shadows of all are those cast onto Earth by the lovely "Evening Star" Venus as it goes between the Earth and the Sun. These majestic transits of Venus occur at most two in a century; after the 2012 transit, there is not a chance to observe this phenomenon until 2117, while the more common sweep of a total solar eclipse creates one of the most dramatic and awe-inspiring events of nature. Though it may have once been a source of consternation or dread, solar eclipses now lead thousands of amateur astronomers and "eclipse-chasers" to travel the globe in order to experience the dramatic view under "totality." These phenomena are among the most spectacular available to observers and are given their full due in Westfall and Sheehan's comprehensive study.

Much of what is known about the universe comes from the study of celestial shadows—eclipses, transits, and occultations. The most dramatic are total eclipses of the Sun, which constitute one of the most dramatic and awe-inspiring events of nature. Though once a source of consternation or dread, solar eclipses now lead thousands of amateur astronomers and eclipse-chasers to travel to remote points on the globe to savor their beauty and the adrenaline-rush of experiencing totality, and were long the only source of information about the hauntingly beautiful chromosphere and corona of the Sun. Long before Columbus, the curved shadow of the Earth on the Moon during a lunar eclipse revealed that we inhabit a round world. The rare and wonderful transits of Venus, which occur as it passes between the Earth and the Sun, inspired eighteenth century expeditions to measure the distance from the Earth to the Sun, while the recent transits of 2004 and 2012 were the most widely observed ever—and still produced results of great scientific value. Eclipses, transits and occultations involving the planets, their satellites, asteroids and stars have helped astronomers to work out the dimensions and shapes of celestial objects—even, in some cases, hitherto unsuspected rings or atmospheres—and now transits have become leading tools for discovering and analyzing planets orbiting other stars. This book is a richly illustrated account of these dramatic and instructive astronomical phenomena. Westfall and Sheehan have produced a comprehensive study that includes historical details about past observations of celestial shadows, what we have learned from them, and how present-day observers—casual or serious—can get the most out of their own observations.



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