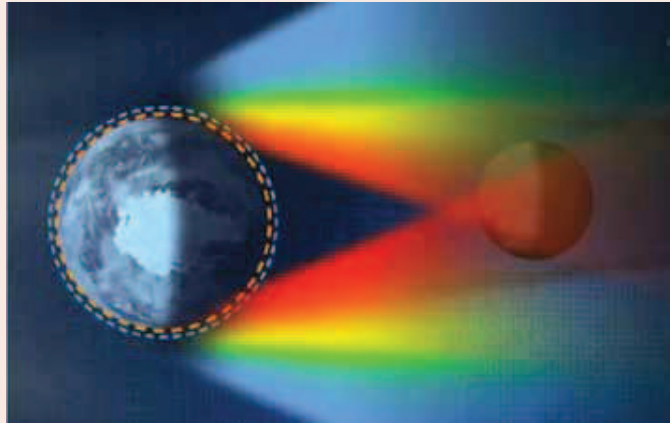


# Eclipses: the Science and the Pseudoscience

Eclipses, whether of the sun or the moon, are not rare. There are from two to five solar eclipses that can be viewed from somewhere on earth each year, and every year there is at least one lunar eclipse of one type or another. “Total” lunar eclipses are those for which the entire moon is covered by the earth’s full shadow (the umbra) at some time during the eclipse. “Partial” eclipses are those for which only a portion of the moon’s surface is covered by the earth’s full shadow, and “penumbral” eclipses are those for which no part of the moon is covered by the earth’s umbra, but a portion of the moon is slightly darkened by being in the earth’s partial shadow, or penumbra. Penumbral eclipses are usually too faint to be observed by the unaided eye. The other two types can be seen by anyone who is on the night side of the earth when the eclipse occurs, unless their visibility is obscured by clouds.

It might be thought that during a total lunar eclipse the face of the moon could not be seen at all, since the moon’s entire surface is in the geometric shadow of the earth. However, the accompanying graphic from NASA shows how some sunlight is bent (refracted) as it passes through the earth’s atmosphere, and thereby reaches the moon’s surface. The shorter blue wavelengths are scattered by the earth’s atmosphere and the light that does reach the moon during a lunar eclipse therefore takes on a reddish tinge. The reddening becomes more pronounced and deeper when the moon is viewed from those longitudes of the earth where it is just after sunset or just before sunrise. In these cases, the light returning to the earth again travels horizontally through the earth’s atmosphere and undergoes further reddening, taking on a dark red color. An additional phenomenon in effect for such observers is that the moon, when observed at the horizon, appears to be enlarged. NASA (2011) states that “For reasons not fully understood by astronomers or psychologists, low hanging moons look unnaturally large when they beam through trees, buildings, and other foreground objects.” This phenomenon has been known for a long time, and an explanation was offered by the Christian philosopher George Berkeley (1709) in his insightful book on the theory of vision. These two effects—the apparent enlargement of the moon when seen on or near the horizon, and its reddening during an eclipse—combine to make a lunar eclipse viewed at sunset or sunrise an impressive sight. The accompanying article touches on the psychological effect this must have had on the people



NASA 2011

**NASA diagram showing the diffraction of the sun’s rays** during a total lunar eclipse, whereby the light striking the (otherwise dark) surface of the moon take on a red color. Observers at the top or bottom of the globe in this diagram would be observing the effect at sunrise or at sunset, and for them there would be a special second reddening as the reflected light returns horizontally through the atmosphere.

of Jerusalem at the time of the lunar eclipse immediately after the death of Christ.

As explained in the associated article, the timing of the lunar eclipse at the death of Christ has only been established since 1981, and the Christian community has not had long to reflect on its significance. Recently, however, there has been an unfortunate misuse of the science of eclipses that can only

tend to discredit the genuine science associated with the lunar eclipse of AD 33. A popular speaker has claimed in his television show that there will be blood-red lunar eclipses visible at Jerusalem on April 15, 2014 and April 4, 2015 at the start of Passover in these two years, and on October 8, 2014 at the time of the Feast of Tabernacles in that year. It is then claimed that this is not the speaker’s idea, but comes straight from NASA. NASA is also cited as showing there will be a solar eclipse on March 20, 2015. These phenomena are presented as signs of the end times for Israel and the world.

Despite such claims, NASA tables show that Jerusalem will be on the day side of the earth all during the two lunar eclipses of 2014, and hence these eclipses will not be visible from Jerusalem, much less be seen as blood-red from there. The lunar eclipse of September 28, 2015 will be visible from Jerusalem just before sunrise, and will indeed appear blood-red to those who rise early enough to see it. The shadow of the solar eclipse of March 20, 2015 will pass between Iceland and Great Britain in the far North Atlantic. Hardly anyone will see it unless they make a special effort to be in its path. The pseudoscience that has misrepresented these astronomical facts can be a stumbling block to anyone investigating the claims of Christianity. Whereas true science is always on the side of the Gospel, any dishonest or questionable means used to support the cause of Christ will cause skeptics to think that they can also ignore valid arguments that support God’s eternal truth.

— Rodger C. Young

## Bibliography

### Berkeley, George

1709 An Essay towards a new theory of vision. Gale Ecco, 2010; originally published in Dublin, Ireland, in AD 1709.

### NASA

2011 <http://www.youtube.com/watch?v=iTieUYK112o> (video explaining eclipses).