Sky maps for observing planets and bright stars during twilight – introduction

Robert C. Victor and Robert D. Miller

Organizing a star party for a class or assigning individual sky watching? We suggest you plan to begin the sessions during evening twilight, so students can experience the joy of discovering and identifying the brighter stars as they first appear. The sessions should begin no later than one-half hour after sunset, or even earlier if you wish to start with telescopic observations of the Moon or bright planets, and conclude after enough dark-sky time for students to observe the deep sky objects on your list.

If you also schedule a predawn session, you might want to allow enough time to observe a selection of stars and deep sky objects before twilight begins. In that case, start the session at least 1½ to 2 hours before sunrise, and continue long enough into twilight to watch some of the brighter stars disappear.

My friend and former colleague at Michigan State University, Mr. Robert D. Miller, has kindly created computer programs and provided us with monthly sky charts tracking daily locations of the five naked-eye planets and the 15* stars of first magnitude or brighter (*plus Pollux's twin, Castor, of mag. 1.6 and only 4.5° away) visible from latitude 40° north. Positions of the stars and planets are plotted each day at the moment the Sun is 9° below the horizon, which we have called "mid-twilight". Locations of the planets are plotted as a separate dot for each day, with larger dots plotted weekly on the 1st, 8th, 15th, 22nd, and 29th day of the month. Star positions during the course of the month are plotted as continuous tracks, with all stars drifting westward (left to right on the charts) in the course of the month, owing to the Earth's revolution around the Sun.

For latitude 40° N, the moment of evening mid-twilight during the course of the year occurs 43 to 53 minutes after sunset, and morning mid-twilight occurs a similar interval ahead of sunrise.

Sometimes a star is below the horizon at the start of a month, but might appear above the eastern horizon before month's end, for example Spica low in ESE in evening mid-twilight in late April. On the evening twilight chart for May, Aldebaran, Sirius, and Betelgeuse are low in the western sky at the start of May, but all sink below the horizon in the course of the month.

It is instructive to view the monthly evening twilight charts in order, to follow the seasonal westward drift of the stars. The outer planets Mars, Jupiter, and Saturn, moving slowly against the stars, are dragged along with the seasonal motion. Outer planets and zodiacal stars Aldebaran, Pollux and Castor, Regulus, Spica, and Antares follow this sequence from beginning to end of an apparition: (1) First appearance, or heliacal rising, on eastern horizon in morning twilight; (2) progress across morning sky over several months from eastern

toward western horizon; (3) opposition, when it appears in western sky at dawn and in eastern sky at dusk; (4) progress across evening sky over several months from eastern toward western horizon; (5) last appearance, or heliacal setting, on western horizon during evening twilight.

Stars well north of the zodiac, Capella, Arcturus, and the Summer Triangle of Vega, Altair, and Deneb begin step (1) of the next apparition before finishing step (5) of a current one, for example, Arcturus, 33° N of Sun on October 29, begins to be seen rising in ENE before dawn several days earlier, and remains visible in the western sky at dusk until several days later. A star well south of the zodiac, for example, Sirius, is never up all night, even at opposition on Dec. 31-Jan. 1, when it is highest in south in middle of night. For several weeks around the opposite time of year, June 30, Sirius is above the horizon only in the daytime and cannot be seen at any time of night.

Mercury and Venus, planets interior to the Earth's orbit, can never appear at opposition. When they show on the monthly charts, they are either in the western sky at dusk or eastern sky at dawn. Venus is visible as an "evening star" or "morning star" for seven to eight months at a time. Its sequence is: (1) Superior conjunction, not visible on far side of Sun; (2) first appearance above western horizon at dusk; (3) greatest elongation about 46° from setting Sun, while appearing half-full through a telescope. (4) display of crescent phases, ever thinner but larger in apparent size, while sinking back toward western horizon at dusk; (5) inferior conjunction, nearly between Earth and Sun; (6) first appearance above eastern horizon at dawn, beginning display of crescent phases, ever thicker but smaller in apparent size, while climbing toward (7) greatest elongation, about 46° from rising Sun, appearing half full, followed by (8) gradual descent toward last appearance on eastern horizon at dawn, and finally (9) superior conjunction. The duration of a complete cycle of visibility of Venus, including an evening and a morning appearance between superior conjunctions, is nearly 19.2 months, or 5 complete evening-morning cycles in 8 years.

Robert C. Victor was Staff Astronomer at Abrams Planetarium, Michigan State University. He is now retired and enjoys promoting sky watching to folks of all ages in and around Palm Springs.

Robert D. Miller, who provided the twilight charts, did graduate work in Planetarium Science and later astronomy and computer science at Michigan State University and remains active in research and public outreach in astronomy.

Dr. Jeffrey L. Hunt, a retired planetarium director now living in the Chicago area, has taught astronomy and sky watching to all ages. He studied astronomy education at Abrams Planetarium at Michigan State University. Jeff provided the graphs of Moon and planet set and rise times, and the charts depicting and explaining the retrograde motion of Mars. He writes an astronomy blog at jeffreylhunt.wordpress.com.