

How to See Stars in the Daytime

IF YOU'RE looking for a challenge, try locating the brightest stars in the daytime with a telescope. It's an educational pursuit that will deepen your knowledge of both your telescope and the celestial sphere. The search might also enhance your ability to find dim objects in light-polluted skies and allow you to begin your star parties earlier than usual.

In 1635 French astronomer-astrologer Jean-Baptiste Morin began this pastime when he spotted Arcturus in a deep blue sky with his Galilean telescope (*S&T*: August 1987, page 174). Today 2nd-magnitude and brighter stars are routinely observed by day with the U. S. Naval Observatory's 6-inch transit circle as part of an astrometry program. Necessity, however, was the source of my interest in the pursuit.

In my self-appointed role as Baltimore's Street Corner Astronomer, I have learned that passersby enjoy telescopic views of the heavens during the day as well as at night. In fact, I like to believe that my debut at the 1988 spring fair at Johns Hopkins University introduced more people to Venus in the daytime than anyone has since the invention of the telescope. But aside from the perennial favorites, such as the Sun, Moon, and Venus, you might want to show a star. It's a wonderful way to demonstrate that the stars always shine above us but are obscured by sunlight. It's also a fine way to introduce indirectly the problem of light pollution.

Locating a bright star in daylight is no easy task. To gain an appreciation of how difficult it is to do this, go out a half hour or more before sunrise and follow one into the morning with your telescope. How suddenly does it fade into the sky background? What magnification provides the best view? When, if at all, do you lose sight of it? How difficult is it to keep the star in focus during moments of bad seeing? Try doing this for stars of different magnitudes.

THE DAYTIME CHALLENGE

The real challenge is to begin your search with the Sun already up. It's best to look when the target is on the meridian and the Sun is low in the east or



To test your skills as an observer, try finding stars in the daytime with your telescope. Shortly before sunrise last November 14th, *Sky & Telescope* associate editor Stephen James O'Meara took this exposure of Sirius from near the 14,000-foot-level of Popocatepetl volcano in Mexico.

west. Serviceable transit times can be determined from a good planisphere that shows daytime hours (such as the Kennedal Precision Planet and Star Locator, available from Sky Publishing for \$19.95). For enhanced accuracy, I've taped a thin string to my planisphere to indicate the meridian.

The most accurate way I've found to

locate a daytime star is to calculate its Meridian Transit Time (MTT) by using the following formula:

$MTT = RA - GMST \text{ at } 0^{\text{h}} \text{ Next Day}$,
where *RA* is the star's right ascension and *GMST* is the Greenwich Mean Sidereal Time at 0^h Universal Time on the *next day*. To find the GMST, I refer to the Royal Astronomical Society of

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Baltimore's Street Corner astronomer Herman M. Heyn (wearing blue cap), shows passersby Arcturus in the daytime. Photograph by Isabel Beichl.

Canada's *Observer's Handbook* (available from Sky Publishing for \$12).

The formula will provide any object's MTT to within a minute or two on any date desired. Add 24 hours if the answer is negative. Also, insert your local correction and, when necessary, add one hour for Daylight Saving Time; to get your standard time subtract 4 minutes for each degree you are east of your time zone meridian or add 4 minutes for each degree you are west of it. The table below provides transit times for six bright daytime stars visible this fall.

MERIDIAN TRANSITS 15:00 Local Mean Time

Star	Declination (2000.0)	Magnitude	Date
Spica	-11° 9'	1.0	Aug. 27
Arcturus	19° 11'	0.0	Sept. 9
Antares	-26° 25'	1.0	Oct. 13
Vega	38° 47'	0.0	Nov. 14
Altair	8° 52'	0.8	Dec. 3
Deneb	45° 16'	1.3	Dec. 16

If your telescope is not permanently mounted, you'll need to prepare it the night before, making sure it is both level and polar aligned. You can do this by sighting Polaris and marking the ground for where to place your tripod legs the next day. You'll also need to calibrate the telescope's declination circle on a star of known position.

It is essential to refocus your telescope on a star. An even slightly out-of-focus daytime star dissolves to invisibility against the background sky. With my Meade 8-inch f/10 Schmidt-Cassegrain telescope, I begin my search with a magnification of 80x. That power sufficient-

ly dims the sky to reveal any 1st-magnitude star 40° above the horizon or higher. I've found that at 50x 1st-magnitude stars are hard to spot. Remember, you can always increase the magnification once you've found the star. Unlike extended objects, such as the Moon and planets, stars do not show a disk, so at moderate magnifications they do not appear to dim when magnified. Consequently, as magnification increases, contrast increases, and stars stand out better against the sky background. With 160x I have seen starlike Ganymede (magnitude 4.6) an hour before sunset.

When you're set, turn your prefocused telescope south and aim it at the meridian. Now set the telescope to the star's declination and peer into the eyepiece for the moment of truth.

No matter how accurately you think you've polar aligned, pointed at the meridian, or set your declination circle, don't be surprised if you have to sweep to find your target; small errors invariably creep in and add up. If you search at times other than the MTT, you must slew your telescope the distance in hours and minutes of right ascension to the east or west. Don't despair if you feel as if you're looking for a needle in a haystack. With practice you'll routinely enjoy the satisfaction of locating and observing familiar nighttime friends in the blue daytime sky.

Oh, yes — don't be fooled by dust specks, as was Mr. Tregent, London's streetcorner astronomer in 1856: "When the instrument is equatorially mounted and set to time, you can pick out the stars in the day-time, and they look like black specks."

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