

Variable Stars (Supplementary)

[Note: this supplement was included as a non-mandatory component of Explore the Universe, Editions 1–4 (2002-2017)]

Observing variable stars is one of the ways that backyard astronomers can contribute information that is helpful to professional astronomers. Because of the great number of observations required for variable stars, large observatories cannot provide enough observing time for experts to monitor them all. Many of these stars are among the most interesting and beautiful stars in the night sky, and it is well worth the effort to find them. There are four main categories of variable stars including **Pulsating**, **Eruptive**, **Eclipsing** and **Rotating**. Each major category has several specific groups within it.

The **Pulsating** category includes Cepheid variables, RR Lyrae-type stars, RV Tauri-type stars, Omicron Ceti (Mira)-type stars that are also known as Long-Period Variables (LPV). Also included in the Pulsating group are Semi-Regular and Irregular variable stars. The **Eruptive** category includes Supernovae, Novae, Recurrent Novae, U Geminorum type stars, Z Camelopardalis type stars, SU Ursae Majoris type stars, R Coronae Borealis type stars, and Symbiotic stars. The **Eclipsing** category (two or more stars passing in front of one another from our point of view) includes Beta Persei (Algol) type stars, Zeta Aurigae type stars, Beta Lyrae type stars, W Ursae Majoris type stars and Ellipsoidal variables. The **Rotating** category includes RS Canum Venaticorum type stars that undergo small amplitude changes. More information about these specific groups of stars can be found in the *Observer's Handbook* or in other fine observing guides. Another excellent source of information is the American Association of Variable Star Observers (AAVSO). Variable star charts are available from the AAVSO on their Web site.

All of the stars listed here are from the Pulsating and Eclipsing categories. It is important when recording variable star magnitudes to observe the star regularly and to make a note of the date and time of each observation. If your time is limited, it is recommended that you make better observations of a moderate number of variable stars regularly than trying to observe a large number sporadically.

For more information on Variable Stars and Variable Star observing, consult the *Observer's Handbook* and the American Association of Variable Star Observers (AAVSO) at www.aavso.org.

Visual / Binocular Objects

| Season | Cons | Star | Variable Type | Magnitude Range | Period (days) | Spectral Range | RA | Dec | Notes |
|--------|------|------------------------|----------------------|-----------------|---------------|----------------|---------|--------|--|
| Sum | Lyr | Beta 10 Lyrae | E (Eclipsing Binary) | 3.3-4.3 | 12.94 | B8-A8 | 18:50.1 | +33:22 | Bright EB; Proper name Sheliak; use Gamma Lyrae (Mag.3.3) for comparison. |
| Sum | Aql | Eta 55 Aquilae | DCEP (Delta Cepheid) | 3.5-4.4 | 7.17 | F6-G4 | 19:52.5 | +01:00 | Bright Cepheid; use Beta Aquilae (Mag.3.7) for comparison. |
| Aut | Cep | Mu Cephei | SR (Semi-Regular) | 3.4-5.1 | 835 | M2 | 21:43.5 | +58:47 | Known as Herschel's "Garnet Star." Compare colour to the white star Alpha Cephei. |
| Aut | Cep | Delta 27Cephei | DCEP (Delta Cepheid) | 3.5-4.4 | 5.36 | F5-G2 | 22:29.2 | +58:25 | First Cepheid discovered; use Epsilon Cephei (Mag. 4.2) and Zeta Cephei (Mag.3.4) for comparison. |
| Aut | Per | Beta 26 Persei (Algol) | E (Eclipsing Binary) | 2.1-3.4 | 2.86 | B8+G5 | 03:08.2 | +40:57 | Proper name Algol; use Epsilon Per (Mag. 2.9), Delta Per (Mag.3.1), Kappa Per (Mag.3.8), and Gamma And (Mag.2.2) for comparison. |
| Win | Tau | Lambda-35 Tauri | E (Eclipsing Binary) | 3.4-3.9 | 3.95 | B3+A4 | 04:00.7 | +12:29 | Bright eclipsing binary; use Gamma Tauri (Mag. 3.6) and Xi Tauri (Mag. 3.7) for comparison. |
| Win | Gem | Zeta 43 Geminorum | DCEP (Delta Cepheid) | 3.6-4.2 | 10.15 | F7-G3 | 07:04.1 | +20:34 | Bright Cepheid; use Kappa Gem (Mag. 3.6) and Upsilon Gem (Mag. 4.2) for comparison. |

Binocular / Small Telescope Objects

| Season | Cons | Star | Variable Type | Magnitude Range | Period (days) | Spectral Range | R.A. | Dec. | Notes |
|--------|------|-----------------------|--------------------------------|-----------------|---------------|----------------|---------|--------|--|
| Spr | CVn | Y Canum Venaticorum | SR (Semi-regular) | 4.9-5.9 | 298 | C5-4J (N3) | 12:45.1 | +45:26 | Known as "La Superba," it is a deep-red carbon star with a semi-regular period. |
| Sum | Oph | X Ophiuchi | M (Mira, Long Period Variable) | 5.9-8.6 | 338 | M6-K1 | 18:38.3 | +08:50 | Good example of a long-period variable for small instruments; variable-star chart recommended. |
| Sum | Scu | R Scuti | RV (RV Tauri) | 4.2-8.6 | 147 | G0-K0 | 18:47.5 | -05:42 | RV Tauri type variable with cycles of shallow and deep minima. |
| Sum | Lyr | RR Lyrae | RR (RR Lyrae) | 7.1-8.1 | 0.56 | A8-F7 | 19:25.5 | +42:47 | Interesting short-period variable that goes through a complete cycle in less than one day. |
| Aut | Cet | Omicron 68Ceti (Mira) | M (Mira, Long Period Variable) | 2.0-10.1 | 332 | M5-M9 | 02:19.3 | -02:59 | Proper name Mira; has the brightest maxima of all LPV's and is the prototype of its class. |
| Win | Mon | T Monocerotis | DCEP (Delta Cepheid) | 5.6-6.6 | 27.02 | F7-K1 | 06:25.2 | +07:05 | Located near the Rosette Nebula, just north of the star Epsilon Monocerotis. |

Small/Medium Telescope

| Season | Cons | Star | Variable Type | Magnitude Range | Period (days) | Spectral Range | RA | Dec | Notes |
|--------|------|------------|----------------------|-----------------|---------------|----------------|---------|--------|---|
| Spr | Leo | R Leonis | M (Mira, LPV) | 4.4-11.3 | 313 | M8 | 09:47.6 | +11:26 | Bright LPV that is well placed for observing in the spring season. |
| Spr | Vir | R Virginis | M (Mira, LPV) | 6.1-12.1 | 146 | M4.5 | 12:38.5 | +06:59 | LPV with a shorter-than-average period of just 145 days. |
| Sum | Aql | R Aquilae | M (Mira, LPV) | 5.5-12.1 | 270 | M5-M9 | 19:06.4 | +08:14 | The brightest LPV in Aquila. Its red colour intensifies around minima. |
| Aut | Cep | S Cephei | M (Mira, LPV) | 7.4-12.9 | 486 | C7(N8) | 21:35.2 | +78:37 | A carbon star that is one of the reddest known. Look for it between Kappa and Gamma Cephei. It will be reddest around minima. |
| Win | Tau | RW Tauri | E (Eclipsing Binary) | 7.9-11.4 | 2.76 | B8+K0 | 04:03.9 | +28:08 | An interesting EB that drops 3.5 magnitudes during eclipse. It is located near the star 41 Tauri. |
| Win | Lep | R Leporis | M (Mira, LPV) | 5.5-11.7 | 445 | C6 | 04:59.6 | -14:48 | Known as Hind's "Crimson Star," it is a red carbon star that displays a deep red crimson hue around minima. |
| Win | Ori | U Orionis | M (Mira, LPV) | 4.8-13.0 | 372 | M6.5 | 05:55.8 | +20:10 | An excellent LPV that features a large range in brightness. Find it near 54 and 57 Orionis. |