apparent because, as in a motion picture or cathode-ray-tube monitor, the flicker is too rapid for the eye to follow.

Color photographs of the Crab Nebula reveal a celestial gift: a package of bluish synchrotron radiation wrapped in the loops of a tattered red ribbon—fragments of the shattered star, fluorescing in hydrogen-alpha light. Unfortunately, the luminance of the fluorescence is below the threshold for vision in the red part of the spectrum. Thus all we see is the ghostly cloud of synchrotron radiation.

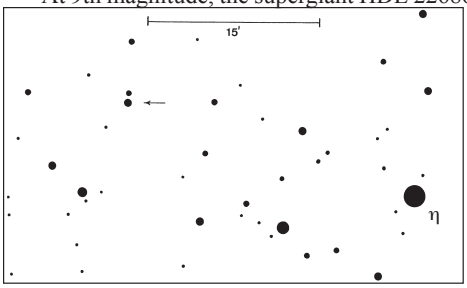
The Crab Nebula is located 1° northwest of the star ζ Tau, at the tip of the east horn of Taurus. In the JANUARY ALL-SKY MAP on p. 340, the nebula is the tiny circle of dots 5 mm to the right of the cross marking the summer solstice (SS). In a telescope, the nebula appears merely as a small glowing cloud, but to the knowledgeable observer, this synchrotron radiation brake of a spinning neutron star is an object for profound contemplation.

Black Holes

Stars whose masses are greater than about 20 solar masses likely retain more than 3 solar masses in their imploding cores. This is sufficient that gravitation will overwhelm not only the degeneracy pressure of electrons, but also the highly incompressible nature of nuclear matter. Within seconds, spacetime itself closes around the imploding stellar core, removing all but the core's gravitational field from the observable Universe. The star has become a black hole.

The earliest and best candidate for a stellar black hole is **Cygnus X-1**. Discovered by Dr. Tom Bolton of the University of Toronto, using the 1.88-m telescope at the David Dunlap Observatory (see p. 11), it is one of the strongest galactic X-ray sources in the sky. Cygnus X-1 is the invisible companion of a star that can be seen in a small telescope: HDE 226868, an O9.7Iab star, a very luminous, very hot supergiant located about 8000 ly from the Sun. It orbits its nearby, unseen companion with a 5.6-day period. The mass of the companion is between 10 and 16 solar masses, far too large for it to be a white dwarf or neutron star. X-rays are generated as material from the supergiant falls toward the invisible companion. The X-rays extend to energies of 100 keV and vary on time scales as short as milliseconds, indicative of a very compact companion.

At 9th magnitude, the supergiant HDE 226868 is visible in any small telescope. It is less than half a degree from the 4th-magnitude star η Cygni, which is the star in the neck of the swan, next to the "C" in CYGNUS on the SEPTEMBER ALL-SKY MAP on p. 344. Any low magnification will more than encompass the field shown in the **finder chart** at left. North is upward, η Cygni is at the lower right, and HDE 226868 is indicated by the small arrow. The chart magnitude limit is about 13. Although HDE 226868 is a blue supergiant, in telescopes of sufficient aperture this star appears orange because of interstellar dust between us and the star.



All that is to be seen is the hot supergiant, but the view will be worth the search if you know that at this same location in the field of your telescope lurks one of the most likely candidates for a black hole, a knot in the fabric of spacetime where a giant star has vanished. No painting, computer simulation, or Hollywood movie can match this observation.

For a discussion on visually observing quasars by Ian Wheelband and Blake Nancarrow of Toronto, go to rasc.ca/supplements