

Deep-sky observing

Explore the sky's spooky reflection nebulae

You'll need a big scope and a dark sky to explore the van den Bergh catalog's challenging objects.
text and images by Thomas V. Davis

Reflection nebulae are the unsung sapphires of the sky. These vast glowing regions represent clouds of dust and cold hydrogen scattered throughout the Milky Way. Reflection nebulae mainly glow with subtle blue light because of scattering — the principle that gives us our blue daytime sky.

Unlike the better-known red emission nebulae, stars associated with reflection nebulae are not near enough or hot enough to cause the nebula's gas to ionize. Ionization is what gives hydrogen that characteristic red color. The star in a reflection nebula merely illuminates surrounding dust and gas.

Many catalogs containing bright emission nebulae and fascinating planetary nebulae exist. Conversely, there's only one major catalog of reflection nebulae.

Reflections of starlight

Canadian astronomer Sidney van den Bergh published a list of reflection nebulae in *The Astronomical Journal* in 1966. His intent was to catalog "all BD and CD stars north of declination -33° which are surrounded by reflection nebulosity ..."

BD stands for *Bonner Durchmusterung*, a comprehensive astrometric catalog of stars spanning the entire northern sky, processed by the Bonn (Germany) Observatory from 1859 to 1903. The BD catalog includes 325,000 stars as faint as visual magnitude 10.

Conversely, CD stands for *Cordoba Durchmusterung*, a similar astrometric star catalog compiled in Cordoba, Argentina. It covers the southern sky.

Van den Bergh used those star catalogs and photographic plates from the

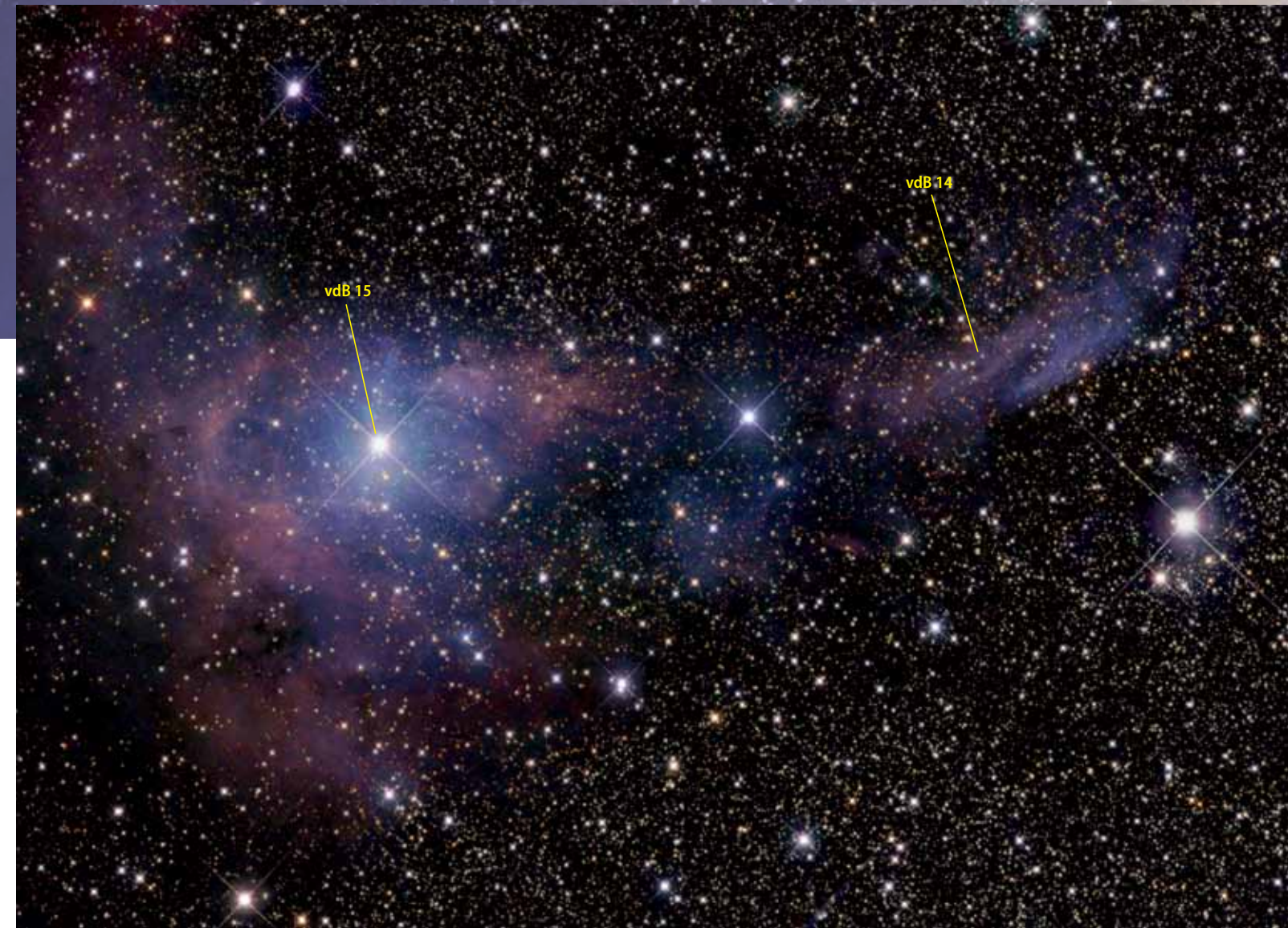
Thomas V. Davis images faint objects under the dark skies of Inkom, Idaho.



The Iris Nebula (NGC 7023) also carries the designation van den Bergh (vdB) 139. This beautiful, flower-like cloud of gas and dust sits in Cepheus. The author combined a total of 6 hours and 6 minutes of exposures to record the faint detail in this image.



vdB 132 in Cygnus (the fuzzy blue area in the center) required a total of 8 hours and 50 minutes of exposures, and it still appears faint against the glowing red hydrogen clouds of the Gamma Cygni region.



vdB 14 and vdB 15 in Camelopardalis are so faint they essentially lie outside the realm of visual observers. This LRGB image combines 330 minutes of unfiltered (L) exposures, 70 minutes through red (R) and blue (B) filters, and 60 minutes through a green (G) filter.



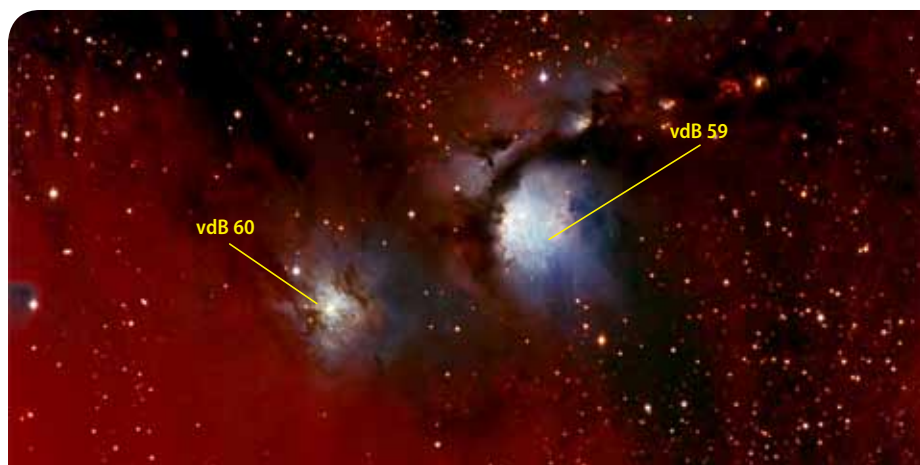
The Pleiades (M45) contains four van den Bergh objects. The brightest and most famous — vdB 22 — surrounds the star Merope (23 Tauri). Reflection nebulae vdB 20, vdB 21, and vdB 23 also lie within this complex.



The Flaming Star Nebula (IC 405) in Auriga also carries the designation vdB 34. Most of the gas here glows red by reemitting radiation from the hot star AE Aurigae. Sidney van den Bergh found a blue component to this object, and made it number 34 in his catalog.



vdB 149 and vdB 150 are small faint reflection nebulae that lie within a massive dust cloud in Cepheus. The author required more than 10 hours of total exposure time to record this region. The dark nebula just above vdB 150 is Lynds Dark Nebula 1235.



M78 in Orion is the sky's brightest reflection nebula, but there's a lot more going on in this region than reflection. Emission nebulosity (in red) and dark nebulae also abound. Two of M78's blue components carry the designations vdB 59 and vdB 60.

Palomar Sky Survey taken with the 48-inch Samuel Oschin Schmidt camera to identify reflection nebulae. In his original paper, van den Bergh said, "To avoid inclusion of doubtful objects and plate defects only those nebulae which were visible on both the blue and red prints ... were included in the final catalog."

The catalog lists 158 reflection nebulae. The nearer nebulae lay predominantly in Gould's Belt, a collection of stars that forms a roughly elliptical ring 3,000 light-years across and tilts 20° to the galactic plane. The more distant nebulae lie mainly along the galactic equator.

Van den Bergh added comments regarding the size of each nebula, the illuminating star, that star's position relative to the nebula (embedded or outside), the star's spectral type, and the nebula's brightness and color.

Many reflection nebulae are difficult for visual observers to find because those objects are so dim. However, with the introduction of charge-coupled device (CCD) technology, amateur astronomers are finding it easier to locate — and especially image — them. Indeed, astroimages now offer up the once-hidden secrets of these dusty nebulae.

Astronomers have determined this dust is complex and non-spherical. It's predominantly silicon dioxide, amorphous carbon, iron silicates, magnesium, and water ice. These dust particles are minute (10^{-5} centimeters) and often align with the Milky Way's magnetic field. This slightly polarizes the reflected light.

The dust within a reflection nebula scatters short-wavelength (blue) light more efficiently than longer wavelength (red) light. That's what gives these nebulae their classic, but not all inclusive, blue appearance on digital and film images.

Delve into the catalog

Objects in the van den Bergh (vdB) catalog vary from small, indistinguishable wisps to large, commanding patches of nebulosity. Amateur astroimagers have not photographed many of these objects to any level of detail, but amateurs seasonally target a few of the brighter ones as the celestial sphere marches overhead.

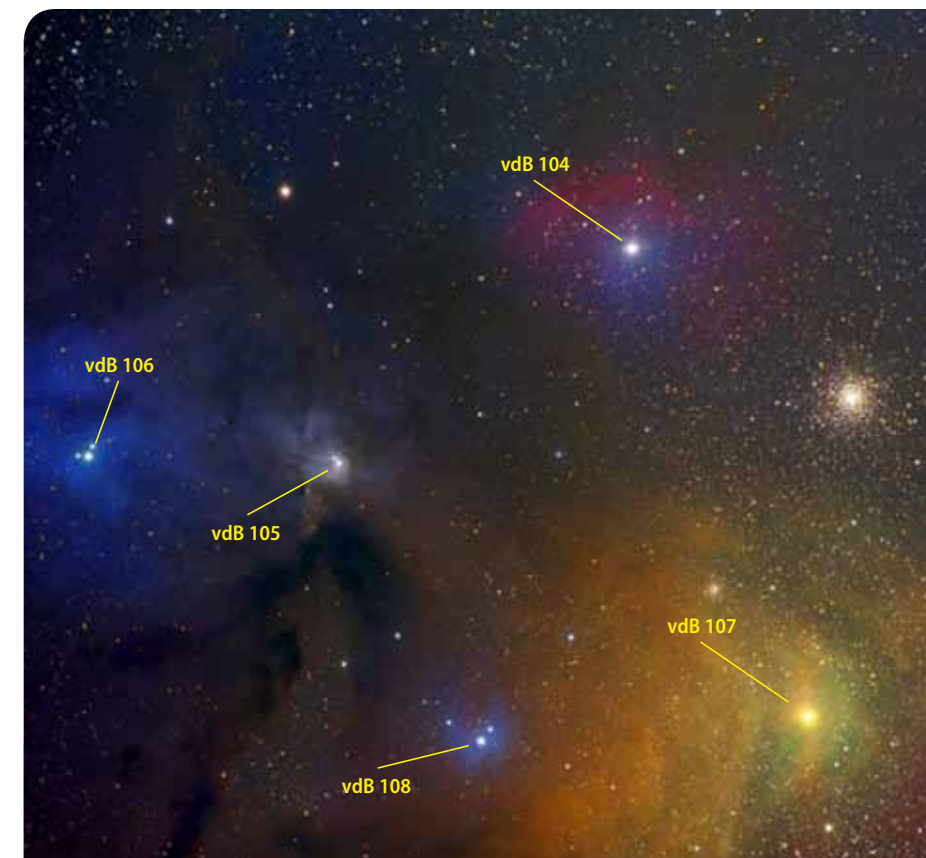


Astrophotographers don't commonly image vdB 27 in Taurus because it's so faint. The region shows a wealth of reflection and dark nebulosity. The author combined exposures totaling 640 minutes of exposure time to produce this image.

Some of the more popular, yet unrecognized, vdB objects include the nebulosity surrounding the stars of the Pleiades (M45). Amateur astronomers know vdB 22 as the famous Merope Nebula (NGC 1435), which surrounds 22 Tauri. Conversely, vdB 20, 21, and 23 represent nebulae associated with the Pleiades' "sister" stars Electra (17 Tauri), Maia (20 Tau), and Alcyone (Zeta [ζ] Tau), respectively.

Another commonly imaged vdB object is number 139, also known as the Iris Nebula (NGC 7023). Extensive clouds of dust surround this reflection nebula. These clouds often go undetected in images with narrow fields of view. All of these dust clouds are parts of the same extensive system.

Other frequently visited, yet unrecognized, vdB objects include vdB 59 and 60 (also known as M78 — the sky's brightest reflection nebula); vdB 34 (the Flaming Star Nebula [IC 405]); vdB 17 (in NGC 1333); vdB 106 (in the Rho Ophiuchi



The Rho Ophiuchi region stretches into neighboring Scorpius. A treasure-trove of different types of objects reside here. Sidney van den Bergh cataloged five reflection nebulae — vdB 104, vdB 105, vdB 106, vdB 107, and vdB 108 — in this region.



vdB 158 in Andromeda is difficult to image because of its low surface-brightness. The author collected a total of 9½ hours of exposures for this shot. Note the small blue planetary nebula PK 110–12 to the upper left of the main blue reflection nebula.

vdB 118 and vdB 119 are tiny reflection nebulae in this wonderfully rich Milky Way region in Sagittarius. It's hard to ignore the beautiful red emission nebulosity here, but, remember, we're focusing on van den Bergh's objects.



Nebula); and vdB 107 (the Antares Nebula). These objects are perennial favorites of amateur astronomers the world over.

Some vdB objects are commonly mislabeled. One such is vdB 142 in Cepheus. This small nebula often erroneously carries the name the Elephant Trunk Nebula. Actually, vdB 142 is the small reflection nebulosity adjacent to the star SAO 33573. The correct designation of the Elephant Trunk Nebula is IC 1396A.

Finally, many van den Bergh objects have no readily available detailed color images. These overlooked gems pass season after season without stirring much interest, going essentially unnoticed while more alluring targets gather all the attention. Today, however, it's easier than ever to capture them. Combine a moderate aperture, fast focal-ratio telescope with a CCD camera, image for long periods (or combine a series of exposures), and you'll reveal the beauty of these once-hidden deep-sky wonders.

Whether you discover the van den Bergh objects by eyepiece or by camera, your reward will be a new depth of satisfaction as you hunt down these overlooked sapphires of the night sky. ♪



vdB 152 (upper left) glows with the characteristic blue color of reflection nebulae at the end of a dusty curtain of dark gas and dust. It lies about 1,400 light-years away, along the northern Milky Way in Cepheus. The entire complex is a huge molecular cloud that will form stars.

 Download a PDF file of the entire van den Bergh catalog at www.Astronomy.com/toc.