EQUIPMENT REVIEW
The DGM Optics OA-3.6ATS off-axis reflector brings amateur astronomers the contrast of a refractor coupled with the color clarity of a reflector. /// BY PHIL HARRINGTON

Off-axis vision

Want to trigger a debate at your next club meeting or star party? Drop this seemingly innocent question on your favorite star gazers: “Which is better: a refractor, reflector, or catadioptric telescope?” Then, as fans of each arm themselves with statistics, preferences, tradition, and their own personal idiosyncrasies, disarm them with this: I know a reasonably priced telescope that combines the high contrast of refractors with the true-color views of reflectors.

As they settle down, remind them of the pros and cons of each design (see “Name that telescope,” page 84). Refractor lovers must cope with chromatic aberration in all but the most expensive apochromatic instruments, and for reflectors and catadioptrics, contrast is their weakness.

Now that your friends are moonstruck, tell them about Dan McShane, an amateur astronomer and telescope maker from Westminster, Massachusetts, who founded DGM Optics in 1996 and began offering clear-aperture reflecting telescopes.

Hidden mirrors
Outwardly, McShane’s design looks just like a conventional Newtonian reflector. But a peek into the tube reveals a difference. Where’s the secondary mirror? Look closely. DGM mounts its flat secondary mirror not centrally, but off-axis.

The secret to this strange geometry is the primary mirror. It looks conventional, but it’s not. If you slice a traditional primary in half, you find the low point of its curve exactly in the center. The DGM off-axis instruments, however, are “off-center,” or more correctly, off-axis. Hard to picture? Imagine taking a standard primary mirror and cutting out three or four small, round sections near the rim. As you can guess, one edge of each small mirror would be higher than the opposite edge.

All DGM’s off-axis mirrors, manufactured by Dodgen Optical of Flagstaff, Arizona, begin as large, on-axis concave paraboloids. Dodgen produces large “parent” mirrors that DGM sections to produce its off-axis paraboloids. As McShane explains, “The parent must be high quality and free of irregularities because it will have a greater negative impact on image quality than with a conventional mirror.”

The performance of a reflecting telescope also depends on mirror coatings. As light reflects off a mirror, some light is lost. Special coatings, called “enhanced,” increase reflectivity from the standard 89% to 96%. But nothing in life is free. Coated mirrors generally have a shorter life expectancy than uncoated ones. This coating also may be harder to strip off when realuminizing time comes.

Balancing the pros and cons of special coatings, DGM enhances its secondary mirrors but not its primary mirrors.

The test subject
For this review, DGM supplied their smallest instrument, the OA-3.6ATS, a 3.6-inch f/11.1 reflector. The optical tube assembly (OTA) measures 40 inches from tip to tip and is built around a white PVC tube. Paying a bit more gets you an aluminum tube, and on some of the larger DGM instruments, a lightweight carbon-fiber tube. The OA-3.6ATS features a 2” RCF-1 Crayford focuser from Jim’s Mobile, Inc. (JMI), but owners must supply their own finder scopes and eyepieces.

Each DGM instrument may be purchased as an OTA alone or on a furniture-quality Dobsonian mount crafted from 5-ply Atlantic birch plywood triple-coated with clear polyurethane. Mount bearings are Ultra-High Molecular Weight (UHMW) Polyethylene and ride smoothly on Teflon pads. Realizing that a small Dobsonian mount can rock, McShane wisely places three short diagonal legs, also made of UHMW Polyethylene, under the ground board. Together, the telescope and mount assembly weighs 25 pounds; the assembly can be carried by gripping the handle on the front of the mount’s rocker box with one hand while placing the other hand under the mount’s base. Construction quality of the OA-3.6ATS’s tube assembly and wooden Dobsonian mount ranks with the best on the market.
DGM OPTICS OA-3.6ATS off-axis reflector is lightweight and simple to set up. An easy-open, hinged bracket holds the telescope tube in place, allowing quick adjustments to the telescope's balance and rotation.

ASTRONOMY: WILLIAM ZUBACK
Construction time
The OA-3.6ATS arrived in two boxes; one contained the tube and optics, and the other the pre-assembled Dobsonian rocker box and ground board. Good packing kept the secondary in alignment. Installing the primary mirror and cell was simple thanks to a well written instruction book.

A hinged, birch plywood cradle with an adjustable latch joins the individual pieces of the DGM optical tube assembly. The hinged cradle lets the observer both slide the tube fore and aft for perfect balance as well as rotate the tube to position the focuser at a convenient angle.

Finally, a Teflon strap clamps over an altitude bearing to secure the telescope to the mount. Tightening the strap controls how freely the telescope moves in altitude.

Optical alignment
Many multiple-mirror off-axis reflectors are difficult to collimate. But the simpler design of the OA-3.6ATS made it easy to collimate, and the manufacturer’s instructions guided me through the process.

The first step, adjusting the secondary mirror, proved unnecessary as the mirror arrived in perfect alignment. If necessary, the mirror can be moved back and forth and left and right. Its holder does not have conventional adjustment screws but moves as a unit instead.

Primary mirror collimation for the OA-3.6ATS is similar to a standard Newtonian telescope. Aim the telescope toward a...
Looking skyward

With the optics fully adapted to the chill of the winter night, I aimed the OA-3.6ATS toward several moderately bright stars. Each showed a well defined Airy disk surrounded by a single diffraction ring — exactly what should be seen through an unobstructed telescope with good optics. Star testing further proved the instrument’s quality. I saw nearly identical diffraction disks on either side of focus, only the slightest hint of spherical aberration, and no signs of astigmatism.

The Moon was stunning through the OA-3.6ATS. Some of my favorite lunar attractions — the craters Copernicus, Clavius, Plato, as well as the Straight Wall, and several major mountain ranges — were so sharp I felt I was almost in lunar orbit. Saturn, riding high in the western evening sky, was my next target. Again, the OA-3.6ATS provided striking image contrast and sharpness from the outset. At 145x, the Cassini Division looked as though drawn by a sharp pencil, and the subtle shading difference between Saturn’s whitish equatorial region and beige temperate zone was conspicuous.

I traveled 1,500 light-years for my next target, the Orion Nebula (M 42). A 3.6-inch aperture — even with excellent optics — shows only so much of faint, ethereal tendrils, yet the variations within the clouds of the nebula were impressive. Filamentary details around the dark projection called the Fish’s Mouth were especially noteworthy at both 145x and at 85x.

Next was the binary star Castor in Gemini. The system’s two bright stars, currently separated by about 4”, were easily resolved at 145x. Beyond that, the OA-3.6ATS showed the pair as two tiny disks of light surrounded by single diffraction rings and separated cleanly by a black gap — a perfect textbook image.

The open cluster M 35, also in Gemini, was magnificent. Cluster stars glistered at 46x. From a dark-sky site, the OA-3.6ATS allowed me to make out just a few of the cluster’s individual stars, none of which shine brighter than magnitude 12.

I turned to Jupiter high in the eastern sky and saw magnificent contrast in the planet’s ribbon-like clouds, along with their delicate swirls and eddies. The Great Red Spot, usually a low-contrast feature through such a small aperture, stood out surprisingly well. Best of all, no hint of false color (chromatic aberration) sneaked through the OA-3.6ATS.

Technical details

As much as I enjoyed the optical excellence of the DGM scope, its mount wobbled enough to cause difficulty focusing short focal-length eyepieces. During my “rap test” — I bump the side of the tube with my open palm while looking through the eyepiece — images took several seconds to settle back down. Placing anti-vibration pads, such as those sold by Celestron and Orion, under the mount’s feet reduced vibration by about a second and is recommended for this scope.

In addition to Dobsonian-mounted instruments, DGM offers OTAs without mounts, giving customers a chance to mate telescopes with mountings of their choice. The OA-3.6ATS would go perfectly on a Vixen Great Polaris, Orion SkyView Pro, or Celestron CG-5 German equatorial mount. Each of these would have the added advantages of slow-motion controls as well as optional clock drives.

DGM off-axis reflectors are great for planet watching and double star observing, but the coarseness of the RCF-1 focuser made attaining a sharp focus difficult. DGM will substitute any focuser, charging the price difference between the RCF-1 and the new unit. I suggest a two-speed focuser such as JMI’s DX-1.

These minor complaints shouldn’t detract from this well made instrument. The OA-3.6ATS is perfect for anyone who wants apochromatic quality without the high cost. If you are a lunar, planetary, or double star observer who longs for a better telescope but has resisted investing thousands of dollars on a top-notch apo, the DGM OA-3.6ATS is your salvation. And besides, you’ll win the debate.

THE MIRROR CELL of the DGM OA-3.6ATS can be adjusted the same way as any Newtonian telescope. Note the primary mirror is not centered in the tube. DANIEL G. MCSHANE

Clear aperture: 92mm ± 1mm
Focal length: 1020mm ± 2%
Secondary mirror: 1.3-inch minor axis elliptical flat
Primary mirror coating: Standard aluminizing (89% reflectivity)
Secondary mirror coating: Enhanced aluminizing (96% reflectivity)
Tube length/diameter: 40 inches long by 6.1 inches wide
Eyepiece height at zenith: 54 inches
Weight of OTA: PVC tube, 7 pounds; aluminum tube, 6 pounds
Weight of mount: 18 pounds
Price: PVC tube assembly: $825
           PVC OTA only: $675
           Aluminum OTA only: $875
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