

Choosing a Telescope for High-Detail Planetary Imaging (and Deep-Sky Astrophotography)

To resolve fine planetary details (Mars surface features, Jupiter's belts, rings of Saturn, even a tiny disk of Neptune), you want a **large, long-focus telescope** with high optical quality. In practice most astrophotographers use **6–12 inch (150–300 mm)** aperture instruments. Larger apertures give finer resolution and brighter images of small planets ¹. Schmidt–Cassegrains (SCTs) and Maksutov–Cassegrains are popular choices: they pack a large aperture and long focal length ($f/10$ – $f/12$) into a relatively compact tube ² ³. For example, an 8" Schmidt–Cassegrain (Celestron C8 or Meade 8") provides around 2000–2500 mm focal length, which many find fits a modest budget and still shows Jupiter and Saturn well ⁴. At the upper end, 9.25", 11" or even 14" SCTs (Celestron/Meade) deliver more detail and can be used for faint outer planets – but they are heavy and costlier ⁵ ⁶.



Figure: A Sky-Watcher Skymax 150 (150 mm Maksutov–Cassegrain) is an example of a planetary telescope with long focal length (1800 mm) and compact size, often mounted on an equatorial tripod.

Important points for planetary scopes:

- **Aperture & focal length:** Bigger is better for resolution. In excellent seeing, 10–14" OTAs can produce "spectacular" planetary images ¹, though even 6–8" scopes are "very capable" when well collimated ⁷. Planets are tiny, so high magnification (hence long focal ratio) is needed ².
- **Optical design:** SCTs and Maksutovs are favored for planets because they give long focal lengths without excessive tube length ². High-quality refractors can work, but a refractor large enough (100–150 mm at $f/7$ – $f/8$) becomes very expensive. Fast large Newtonians or Dobsonians have big apertures cheaply, but are bulky for imaging and usually sit on simple mounts ill-suited to cameras ².
- **Mount tracking:** A motorized mount is recommended to keep the planet centered for several minutes of video capture ⁸. (Planets move slowly, but tracking avoids field drift during a capture.) Alt-azimuth

mounts **can** be used (no field rotation issue over a few minutes), but most imagers prefer a sturdy equatorial mount for reliable tracking ⁸ .

Example planetary setups: A Celestron C8 or C9.25 on a solid mount (e.g. Celestron AVX or CGX) is a common, proven planetary rig. The C8 (8" f/10, ~2000 mm FL) "fits within your budget" and has produced excellent images ⁴ . If budget allows, the C9.25 or C11 (9.25"/11" f/10) give even more detail due to larger aperture and longer focal length ⁵ . For Maksutovs, a Meade 6" f/12 (150 mm FL = 1800 mm) is another classic planetary scope ³ . (Uranus/Neptune imaging is difficult for any, but even these have captured them as small disks ³ .) **Mount capacity matters:** note that many small scopes (C8, 6" Mak) can ride a mid-range mount (~30 lb capacity), but larger OTAs (C11/14") require a heavy mount. For instance, the Celestron AVX mount (~30 lb payload) **cannot** carry an 11" or 14" OTA – you'd need a bigger mount like a Celestron CGX/CGX-L or Sky-Watcher EQ8 ⁶ .

Mount and Tripod Considerations

Since imaging is prioritized, get a **high-quality equatorial mount and tripod**. Under \$5000 total, expect to spend on the order of **\$1,500–\$3,000** on the mount (and tripod). The mount must have **GoTo tracking and capacity for your OTA + camera**. For example, a 8–10" SCT (~3" diameter, ~20–30 lb) works on mounts like Celestron CGX or Sky-Watcher EQ6/EQ8-class. For heavy OTAs (~30–40 lb), consider a CGX or CGX-L (Celestron) or a Losmandy G11/EQ8R (Sky-Watcher) type mount ⁶ ⁹ . A good mount will allow autoguiding for deep-sky (if ever used) and ensure stable tracking for long exposures. As one expert notes, deep-sky imaging "requires more precise mounts and many hours of imaging" ¹⁰ , whereas planetary video capturing is shorter but still benefits from solid tracking ⁸ ¹⁰ .

For **imaging gear**, use a planetary camera (high-frame-rate CMOS) or DSLR on prime focus. A Barlow lens or focal extender is often used to reach desired magnification. (Planetary imagers often shoot video at e.g. f/20 or more and use software stacking.) Since you already have eyepieces and cameras, focus on the OTA+mount: popular pairs include Celestron EdgeHD SCTs on the CGX mount, or a large Maksutov on a robust EQ mount.

Deep-Sky Astrophotography: Fast, Wide-Field Telescopes

Deep-sky imaging (galaxies, nebulae, star clusters) has almost opposite requirements from planets. You want **fast optics (low f-ratio)** and **shorter focal length** to frame large objects. A fast astrograph or refractor (e.g. f/5 or faster) is ideal. In practice this means a **short FL OTA** (a few hundred to ~1000 mm). For instance, Celestron's Rowe-Ackermann Schmidt Astrograph (RASA) 8" or 11" is specifically built for wide-field DSO imaging ¹¹ . Or a high-quality APO refractor (e.g. 80–120 mm at f/5–f/6) can gather light quickly for nebulae and galaxies. Most amateurs find a *separate* small refractor (or RASA) works better for DSOs than trying to repurpose a long-focal "planetary" scope.

The cloudy nights FAQ notes the stark difference: **"Most DSO imaging telescopes are usually less than 1000 mm focal length, while planetary imaging telescopes are even beyond 2500 mm."** ¹² . In other words, a scope that excels at Mars/Jupiter (e.g. 3000 mm FL) is far from optimal for large star fields. A practical compromise might be a versatile mid-size APO (100–120 mm) which can do both to some extent: for example, a 100–120 mm refractor will image stars and galaxies well, and with a Barlow or diagonal it can be used for casual planetary viewing ¹³ .

Mount for deep-sky: Crucial is a stable equatorial mount with guiding. Long exposures (minutes to hours) on faint objects need precise tracking. Almost all deep-sky imagers use a GoTo EQ mount (with auto-guiding), whereas pure planetary imaging can often “get by” on simpler tracking. In your budget, mounts like the Celestron CGX or iOptron CEM70 (\$2,500–\$3,000 range) are great all-purpose platforms (they can carry either a big SCT or a lighter refractor). In summary, if DSO work is a goal, plan to use **fast optics + long exposures + guiding** (and perhaps a field flattener/reducer).

Recommended Configurations and Conclusion

- **For Planets:** A **Schmidt-Cassegrain or Maksutov** in the 8–11” range (e.g. Celestron C9.25 or C11 EdgeHD, or a 6” Maksutov) is optimal ⁵ ³ . Mount it on a sturdy computerized mount (e.g. CGX or EQ8-class). This combination (large aperture + long focal length) will reveal fine planetary detail and even show Uranus/Neptune as small disks ¹ ³ .
- **For Deep Sky:** A **fast, wide-field scope** is better – such as a RASA 8/11, 80–120 mm APO refractor, or fast Newtonian. These gather light quickly over a wide view, ideal for galaxies and nebulae. Pair it with the same high-end mount (tracking + guiding) for best results. Note that “[p]lanetary imaging is usually done in minutes,” whereas deep-sky imaging requires “many hours” under the sky ¹⁰ .

In practice, many astrophotographers with a ~\$5000 budget end up with two setups: one optimized for planets (long FL) and one for deep-sky (fast optics). If forced to choose one telescope only, most advice is to pick the **aperture and focal length** suited to your main interest. For **planetary detail** (Mars, Jupiter, Saturn, etc.), go for a large SCT/Mak on a robust mount ⁵ ⁴ . If **wide-field DSO imaging** is the priority, a fast refractor or astrograph is “better” ¹¹ ¹² . Either way, ensure you have a **quality equatorial mount and tripod** that can carry your OTA and camera.

Sources: Astronomy forums and guides agree that long focal length and large aperture are key for planet imaging ¹ ² , while deep-sky work favors short focal, fast instruments ¹¹ ¹² . (All cited details above are drawn from current astrophotography resources ¹ ⁵ ¹² ⁴ .)

¹ ⁸ Planetary Imaging FAQ - updated January 2025 - Major & Minor Planetary Imaging - Cloudy Nights
<https://www.cloudynights.com/topic/812022-planetary-imaging-faq-updated-january-2025/>

² ⁵ ⁶ ¹¹ Best Telescopes For Planetary Astrophotography | Skies & Scopes
<https://skiesandscopes.com/best-telescopes-for-planetary-imaging/>

³ ⁴ ⁷ Searching for a larger telescope for planetary imaging. - Major & Minor Planetary Imaging - Cloudy Nights
<https://www.cloudynights.com/topic/852348-searching-for-a-larger-telescope-for-planetary-imaging/>

⁹ Ranking All Telescope Mounts in the US - Telescopic Watch
<https://telescopicwatch.com/telescope-mounts-rankings/>

¹⁰ ¹² ¹³ astrophotography scope recommendation - Beginning Deep Sky Imaging - Cloudy Nights
<https://www.cloudynights.com/topic/955159-astrophotography-scope-recommendation/>