# The Hotech Advanced CT Laser Collimator

## Adventures in SCT Collimation with Uncle Rod and the Hotech CT Laser

By "Uncle" Rod Mollise

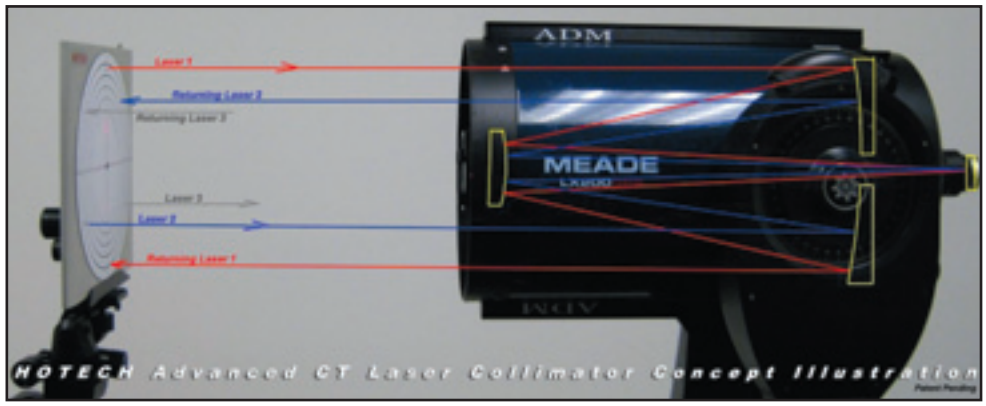


**Image 1 - Schematic describing the basic Hotech Advanced CT Laser Collimator system.**

One of the first things Joe and Jane New Amateur learn is, "You've gotta collimate." If you use a reflecting type telescope, you will have to master the art of adjusting your telescope's mirrors so they are aligned properly if the scope is to deliver all the image quality it's capable of delivering. Collimation isn't just something you need to do to a new telescope, either; it is a constant fact of life for most amateur astronomers. If you own a Newtonian reflector, you will collimate, maybe once in a while, maybe every time you use the telescope.

Schmidt Cassegrain owners are lucky. SCTs require collimation, but if it is done correctly they can go months or even years before re-tweaking is required. Not that we've always considered ourselves lucky. Heck, many SCT owners are afraid to collimate their telescopes. While the Schmidt Cassegrain is at heart a simple little beast, to the new owner it looks scary-high-tech, and the very idea of attacking the screws on the front of the secondary holder sounds like a bad idea.

Which is ironic. SCT collimation is easy. It's a walk in the park compared to Newtonian alignment. With a Newtonian, you have two optical elements to adjust, the primary and secondary. And that secondary can be moved in three axes. The Schmidt Cassegrain, on the other hand, has only one user-adjustable component, and all that is adjustable is its tilt.

All you must do to get an SCT properly adjusted is focus on a medium-bright star, defocus just a little till you can see diffraction rings, making the star look like a bull's-eye target, and, with this "target" centered, adjust the collimation screws until the rings are concentric, not squished on any side. There are a few "rules" to the SCT collimation game; you, for example, should always collimate by tightening screws only if your scope is to hold collimation for any length of time. But mostly it's straightforward and easy to do with only a little practice.

Yep, SCT collimation is so easy even a caveman can do it—unless you want to collimate inside your cave. Polaris is the ultimate collimation tool, but it is, of course, only available under a dark, clear sky. You can use other stars, too, but at times it would be nice to be able to collimate indoors. You want to take a quick weeknight look at Saturn, only have a few minutes to spend with the ringed wonder, and know your scope is badly out of alignment. Or you need to start observing right after sundown before

clouds roll in. Newtonian owners can collimate indoors or in the daytime with ease. Shame SCT owners can't. Or couldn't till now.

There are several ways to collimate a Newtonian without looking at a star, but one of the most popular over the last decade has been with a laser. Put a laser collimator in the focuser, center the red spot on the primary and secondary, and collimation is dead on. Unfortunately, SCT owners who tried the new collimators on their scopes quickly discovered laser collimation was a recipe for SCT mis-collimation.

Why were laser collimators denied to SCT Users? Because for a standard laser collimator to work, everything—the telescope's primary mirror, baffle tube, rear port, and visual back—has to be precisely mechanically aligned. Which isn't often the case for SCTs. That doesn't do a thing to harm image quality or prevent precise collimation, but it does preclude the use of a Newtonian laser collimator.

In addition, for perfect collimation, you need the collimator's beam to be reflected off both a telescope's mirrors. Insert a laser in an SCT's visual back and it is easy to see its beam is just hitting the secondary and being reflected back on itself. The primary is not in play.

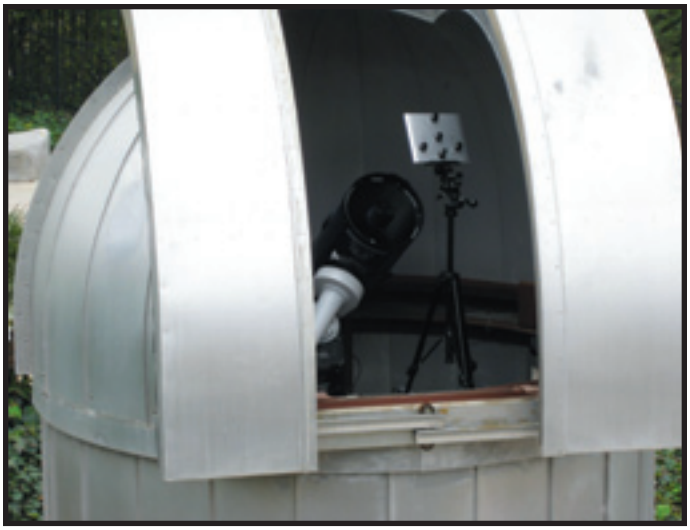

**Image 2 - Hotech Advanded CT Laser Collimator system set-up in the author's observatory.**

So there is no way to collimate an SCT indoors? That's not exactly true. You can use an artificial star, but that's always inconvenient and sometimes impossible. An artificial star, even one of the fancy new LED artificial stars, has to be far enough from the telescope so you can get it close enough to focus to see diffraction rings. You do not have to have the target hundreds of meters away as you may have read—long distances are only needed to star test for optical quality—but you do need enough space to focus properly.

Alas, most homes don't have a long enough run of interior space to permit that. I can place an artificial star in Chaos Manor South's kitchen and a C8 in the

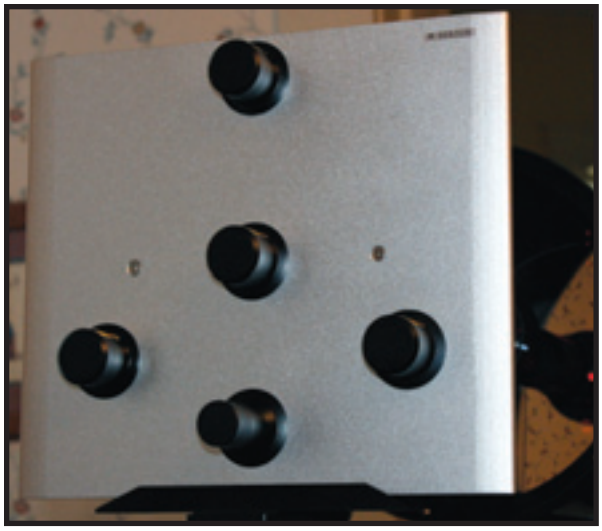

**Image 3 - Individual lasers mounted on the back of the CT Target.**

living room and barely collimate, but I can't do a C11 at all, and our Old Manse is probably larger than most folk's homes.

Sure, you can collimate outdoors with the bugs and the stray cats, maybe using that old standby, the sun shining on a power pole insulator or reflecting off the chrome bumper of a car. Unfortunately, today's cars are deficient in chrome, and what if it's cloudy? You can use an illuminated artificial star, but many people may still not have the space to achieve proper focus.

A laser would be the perfect answer to the daytime/indoor SCT collimation conundrum if one could be made to work with our telescopes. Several manufacturers have marketed laser collimators designed for use with Schmidt Cassegrains, but, while some worked better than others, none worked well.

When I heard David Ho (Hotech) was preparing to market an SCT laser, I was skeptical. Yeah, I knew the man's reputation for quality, but we'd been down this road before hadn't we? Still, I kept my ear to the ground, and eventually heard the Hotech CT ("Cassegrain Telescope") collimator was an SCT laser of a new type.

Naturally, I was anxious to get my hands on the CT for a review, and when David H. agreed to send me an evaluation unit, I was right excited. And maybe a little bit apprehensive. One other thing I was hearing was that the Hotech CT required a far more complicated setup than just sticking a laser pointer in the rear port. Would I be able to make the dang thing work? I've used SCTs for nearly 40 years, and I know a thing or two about 'em, but, as my friends will tell you, I am at heart a fumbler and a bumbler when it comes to technology.

When the collimator arrived, I was immediately impressed by Hotech's attention to detail. This is a nice package, with the laser and its accessories contained in a soft case not unlike what you'd use for a laptop computer. In addition to the collimator itself, in the case was a pair of eye-piece-looking things, a 1.25-inch and 2-inch. Turned out these were mirrors that are inserted in the scope's visual

back to get the beam from the laser, which is pointed down the corrector end of the telescope, propagating through the optical system, hitting the primary mirror as well as the secondary.

How about the laser itself? Actually it's an enclosure equipped with multiple lasers. There are four of them mounted on the unit's back. The whole shebang is powered by a single (included) CR123 battery. The opposite face of the collimator, the side that points to the telescope, is emblazoned with target rings.

What else? There was some scary-looking stuff. Several ruled measuring tapes, a fabric strap with a metal buckle, and some funny-looking plastic "tabs." Looking at the tapes, I began to feel a little apprehensive. In addition to being told I'd have to precisely square the laser with the telescope's corrector, I had heard that would be particularly difficult with a Celestron SCT (all I own).

The shipping box also contained one additional and, I believe, optional item, a tripod fine adjuster. You've no doubt seen these before: altitude-azimuth fine-tuners that attach to a photo tripod's head. If you are contemplating the CT, I urge you to get one, as being able to make fine adjustments of the laser is extremely helpful, and can preserve your sanity and your hairline. A sturdy tripod is also desirable—the CT is mounted on a 1/4-20 thread tripod for use. I used our Manfrotto, though I found an inexpensive Focal tripod (K-Mart) was useable.

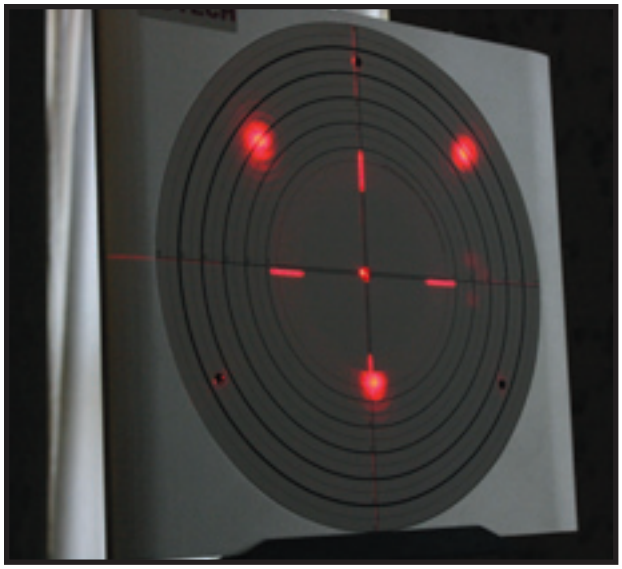

**Image 4 - Laser return spots displayed on the face of the CT Target.**

What next? A look at the manual. Some of the pictures in this laser-printed sheaf of pages were a little small and a little dark, and some of the wording was a bit awkward: "focuser" instead of "visual back," "intercept" when "overlap" is meant, "tangent" when "perpendicular" would have been a better word choice, etc. However, the instructions were good enough; especially when used in concert with the instructional videos available on YouTube. The good news is that David has revised the manual and the all-important instructions are

Image 5 - A high-quality padded case is included for safe storage and transport of the Hotech Advanced CT Laser Collimator system.

now easier to follow.

Let me make sure I am clear about something: I know you are used to me being cavalier about and joking about instruction manuals. I've often told y'all that the first thing I do when I get a new piece of kit is throw the manual in the old rubbish bin. Not this time. READ THE INSTRUCTIONS. Then read 'em again—several times. Watch the videos. Then watch them again, several times. I guar-ron-tee that if you don't, you will never figure this thing out.

"Time to get cracking. Let's take one last look at the manual." Which was when I hit the first bump in the road. The instructions warn you not to set up on carpeted or wooden floors, only on a sturdy surface with no give. Well…I got news: Chaos Manor South ain't got nothing but wooden floors, and I suspect many other folks, even those who don't live in ancient Victorian houses, are in the same boat. I could go outside, but one of the beauties of this rig, I thought, was that you could use it inside. When all was said and done I found I didn't have any trouble collimating on a wood floor as long as I mounted the collimator on a sturdy tripod.

The first step in the CT collimation procedure is getting the collimator properly square-on to the telescope. Doing that with a Meade is fairly easy. With the CT's rotary switch in Mode One (it has three modes), which projects a crosshair pattern, you aim the scope and collimator at each other so three screws inside the tube near the primary mirror are illuminated. The trouble for a Celestron owner is that Celestrons do not have three screws spaced at 90 degree intervals at the mirror cell end. I'd have to make my own marks via the measuring tapes and "tabs." Rut-roh.

Whether you've got a Meade or Celestron, before you can point the colli-

mator to the screws or tabs, you first have to place the collimator the proper distance from the scope. That will depend on the scope focal length, but it's less than one tube-length in front of the corrector for my C8. Start out about there, move the collimator and tripod forward or back until the crosshairs are their smallest, then move toward the scope till the crosshair pattern projected onto the collimator's target-face extends to the first bulls-eye ring.

Once you've achieved a good crosshair pattern on the CT's target, you are approximately aligned as well as at the right distance. But you must be precisely aligned to produce a good collimation.

Referring to the manual, I grabbed one of the lengths of measuring tape, which turned out to be surprisingly easy to use. No critical measurements are required. Wrap the tape around the rear cell and mark the overlap point on the tape with a pencil. Remove the tape, keeping it overlapped. Fold it twice so it's one quarter its original length, and mark a starting "0" position on the top of the telescope's rear cell with a pencil or use some other convenient reference. My C8 has a screw on the rear cell perfect for that. From there, use the folded tape to mark two "90 degree" positions on either side of the 0 mark.

90-degree marks made, all I had to do was wrap the supplied fabric strap around the rear cell, fasten its buckle, and slide the three provided plastic tabs under it at the three marked positions. It seemed kinda Rube Goldberg, but worked fine and was more than precise enough. In practice, I found I could tell when the collimator was properly aimed just by eyeballing the three laser spots on the edges of the C8's mirror. The tabs helped get everything lined up properly, though, and if you are collimating a Celestron, you should definitely use them. In fact, even if you have a Meade, you might want to use the tabs; I believe they will speed up the process of aiming.


**Image 6 - The CT Target face displays another Mode of the Hotect Advanced CT Laser Collimator.**

Getting C8 and CT positioned with the three laser beam crosshairs on the

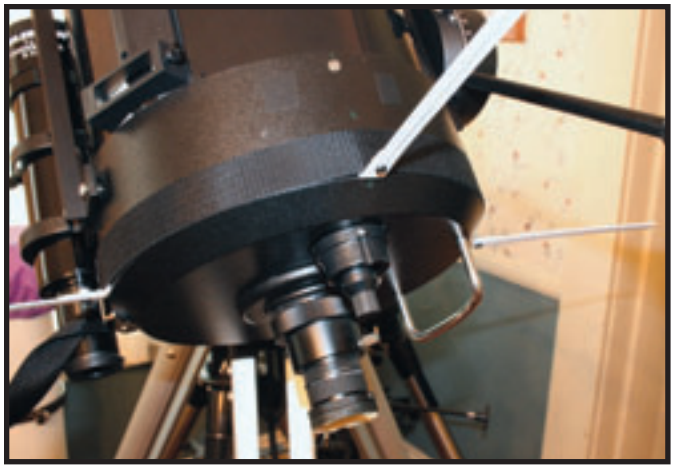

Image 7 - Alignment tabs attached to the SCT's rear cell.

tabs (in the case of a Meade that would be "on the screws") and the crosshair reflection centered on the first target ring took some doing, crying, and whining the first time out. The problem is that you've got so much freedom of adjustment when you combine all the possible movements of collimator and scope that it gets confusing. How do you keep out of trouble and resist the urge to throw the CT against the wall?

FOLLOW THE INSTRUCTIONS! If you do, you'll find the alignment process is a two-step affair with no mystery to it. First you aim the laser at the tabs (or the screws), then you aim the telescope so the projected crosshairs are centered in the first bulls-eye ring on the CT. Keep doing these things in turn; adjusting by small amounts, till the tabs or screws are illuminated and the crosshairs are centered on the collimator.

Even with a fair idea of what I should be doing thanks to the manual and the videos, I easily spent a solid hour getting scope and CT properly aligned the first time. Like anything else, of course, what was difficult that first time was easy the second. The next time, getting scope and laser lined-up took all of 15 minutes.

Since, as SCT mavens will tell you, the Schmidt Cassegrain's mirror can change position slightly depending on whether the tube is level or pointing at the sky, it might be a good idea to collimate with the laser elevated, so the tube can be at an up-angle. The first time, however, you will have your hands full getting the feel of the CT, and I urge you to get comfortable with it with collimator and scope both level. Having the SCT on an alt-azimuth type mount makes the process easier, too. While my C8 normally rides on a German equatorial mount, I placed her on my Synta AZ-4 alt-az for collimation.

With scope and laser properly positioned near as I could tell, it was time to collimate. Which turned out to be slightly anticlimactic. Once you master the art of squaring CT and SCT, all that's left is the old "which screw do I tweak?" routine. Well, almost.

Before you can begin collimation, you must turn the rotary switch on the top of the collimator to one of its other two modes. Mode Two turns on the collimation lasers, and Mode Three provides a combination of collimation laser spots and crosshairs. I chose Mode Three so I could be sure the telescope and collimator were still properly aimed (I am famous for kicking tripod legs).

When I switched the CT to Mode Three, the three laser spots I was supposed to see were nowhere to be found. What had I screwed up now? I could see three small laser dots on the face of the CT if I (mis)adjusted alignment a certain way, but from the instructions and the videos I knew I should be seeing three fat spots. I fiddled and fiddled, but nothing helped. Was I done?

Thankfully, your silly old Uncle had the sense to read the instructions one more time. There was indeed an entry on "What to do if you can't see the laser spots." The first suggestion was to check the return mirror in the visual back. That seemed OK. What next?

The second troubleshooting suggestion was slightly confusingly worded, but the meaning was clear. The telescope's focuser should be close to the focus position it will assume with an eyepiece inserted directly into its visual back. Hey! Wait a minute! The last time I used the C8 was with my Stellacam II and Meade f/3.3 reducer, which throws focus way off from visual. Maybe…

Sure enough, turning the focus control to move the SCT's mirror back to "visual position" caused three laser spots to magically appear on the target.

With them visible, the rest was easy. The three spots were not all on the same bull's-eye ring, so I adjusted the scope's collimation screws till they were. I felt good, though the instructions warned me to check the scope on Polaris' diffraction rings after the first collimation to be sure I'd done things right.

That very night I headed to our local club's dark site. There, I turned the scope to the North Star and defocused slightly. I hoped the CT had worked, since I wasn't in the mood for a full-blown collimation session. I didn't have to do one; the star's diffraction rings were nicely concentric.

My verdict on the Hotech CT Collimator? I hope to improve my setup time, but this unit will never be as quick to use as a Newtonian laser collimator. On the other hand, a Newtonian laser will not work on an SCT, and using the CT Collimator is significantly quicker than using an artificial star in the daytime. The Hotech CT is an attractive piece of gear with outstanding build-quality. Expect to spend some time figuring it out, but when you get to that "OH YEAH!" moment you are gonna be right happy with this thing, muchachos. I give it two thumbs up.

**Stop the presses department:** In the months since I began following the CT's development, one thing that has impressed me is how committed David Ho is to his product. He continues to tweak and innovate and has recently developed a new procedure that makes initial setup considerably easier. This is an important breakthrough, since the only thing I (and most other users) found even marginally difficult was squaring collimator and telescope.

**Image 8 - Aligning the Advanced CT Laser Collimator with help of the alignment tabs.**

The new procedure eliminates the use of the tabs for alignment. Instead, a piece of frosted, matte-finish tape is placed over the collimator's center laser to diffuse the beam. This causes a "donut" of reflected laser light to be projected onto the collimator face. All the user must do is adjust the telescope's aim until this donut is centered on a target ring. You can still use the tabs, but believe you me, this new procedure saves time, keeps the stress level down, and seems just as accurate. ATT