

Compared to alligator wrestling or making breeder reactors in the basement, amateur astronomy is pretty safe. Yet there are a few hazards cautious folks might remember. Many are obvious and familiar, but some may require explanation, especially for beginners. In no special order, here are a few, with thoughts on how to deal with them.

#### TELESOPES AND THE SUN:

Malicious kids sometimes focus sunlight with magnifying glasses to "burn ants". Telescopes concentrate sunlight well enough to be pretty good at burning ants -- or at burning eyeballs. NEVER OBSERVE THE SUN WITHOUT SPECIAL EQUIPMENT TO REDUCE THE INTENSITY OF SUNLIGHT.

Equipment options for solar observing change often. Consult magazines like Sky & Telescope or Astronomy -- or their web sites, <http://www.skypub.com> and <http://www.kalmbach.com/astro/astronomy.html>, for specifics. For now, let's mention some things you should \*not\* do:

1) Do not use just a filter at the eye end of the telescope. Such filters are exposed to focused solar heat, and may crack unexpectedly, exposing your eye not only to concentrated sunlight, but also to shards of flying glass. Many old telescopes came with such filters. If you find a filter like that, destroy it.

2) Be cautious about ad-hoc or home-made filters. The eye is not good at sensing when concentrated sunlight is too bright. Even a view that "looks dark enough" may damage your eye. Furthermore, it is possible that a filter may block visible light satisfactorily, yet pass enough of wavelengths you cannot see to do harm.

Note that there are no nerves in the interior of the eye -- they'd get in the way of seeing. So if you start heating up the clear liquid in the eyeball, it can get pretty hot before you notice. Then you just have to let your eyeball sizzle and steam, while it cools. Ouch!

A telescope pointed near the sun can be dangerous even if you are not looking through it. The focused spot of sunlight inside it may damage the tube, and perhaps set it on fire. If you are standing near the eye end, concentrated sunlight from the telescope -- or from an uncovered finder telescope -- may burn your skin or clothing.

If a passer-by walks near the front of a telescope that uses a mirror to collect light, while it is pointed near the sun, the converging beam of sunlight may escape from the instrument and "flash" that person in the eyes without warning. The beam may start a fire if it falls on combustible material. Open-framework tubes are particularly

bad this way, because they can be pointing far from the sun and still focus light outside the tube, by oblique reflection.

Unless you are observing the sun, it is probably best to keep astronomical telescope optics covered when the sun is up.

#### ELECTRICAL POWER:

Most modern telescopes with electric power use low-voltage batteries with no hazard of shock or electrocution, but many older ones rely on long line cords and house current. Power cords with a history of being stepped on, wadded up for storage, and spread out on the cold, wet ground, may be dangerous, the more so in places that use 220 volts routinely, instead of the 110 volts in the United States. Be careful of any telescope or accessory that plugs into a wall socket.

Some of us use electronic cameras to capture celestial images. Some image-capture systems use enough voltage to shock you, and this technology is changing fast. So even if this year's high-tech imaging gadgetry should be high-voltage free, next year's might not be. Make sure you know before you start fussing with equipment.

#### AUTOMOBILES:

Most of us live in brightly-lit towns, and transport our telescopes by car out to where the sky is dark. We drive up and down twisty mountain roads, sometimes at night, sometimes when conditions are wet or frosty, and often when we are tired. So we have automobile accidents. Drive safely. Bring coffee. Sleep in your car.

At many star parties, it is customary for those arriving late or leaving early to drive without lights, as much as possible. Everybody appreciates the respect for dark adaptation, but it is all too easy to have fender-benders or collisions with people and equipment. Most of us would rather give up our dark adaptation than have that happen.

If you sleep in your vehicle, chock it in place. An observer I know managed to dislodge the parking brake handle in his sleep, and was rudely awakened as his truck rolled down a steep hillside, bouncing him around inside. Fortunately, no harm was done.

#### EQUIPMENT HANDLING:

Many telescopes are large, heavy, cumbersome, and have lumpy protrusions or parts that fall off. We set them up in the dark, on uncertain footing, perhaps when the grass is wet, and perhaps when we

are tired. So we drop pieces on our feet. We trip over stuff and fall. We bang our heads on things we didn't see. We put our backs out. Different kinds of hardware require different approaches to safety, but do think about what you are doing before you do it. Light-colored components are perhaps easier to see and avoid than dark-colored ones. Position your red flashlight so it illuminates where you are working, or carry it lit, on a cord around your neck.

#### EXPOSURE:

We sit still, outside in the cold, wet night, for hours at a time. So we catch cold. Dress warmly. Bring hot food and coffee. Stay healthy. Remember, it is easier to stay warm than to get warm again after you have already gotten chilled.

#### LADDERS:

Large Newtonians are popular, and many require regular use of a ladder to get to the eyepiece. Don't fall off! Be sure the ladder you use is strong, is set up in a stable manner, and is long enough so that you don't have to teeter uncertainly near the top when you are using it.

#### BIOLOGICAL HAZARDS:

I have no medical training beyond simple first aid, but I do have a recent second baccalaureate in biology, in which I heard about many outdoor biological hazards. I'll relate some of what I learned, but if you need more details, or medical advice, you should seek it from someone who knows a great deal more than I do.

Lions and tigers and bears are rare in most places where we observe. Notwithstanding, there are usually living creatures around, that can do you harm. Most are small and undramatic, and their identity varies from place to place. I will describe what observers at coastal sites in central California might worry about; your concerns may vary.

A) Plants. We have the ubiquitous poison oak, which causes rashes and severe itching in nearly everyone. Learn to identify it, and avoid it. Folks with allergies to pollen or other plant material have their own special problems, possibly varying from season to season.

B) Microorganisms. Many diseases transported by insects and animals are dangerous. Some, such as Lyme disease, rabies, and plague, can kill you. Most are rarely transmitted to humans, but that means lots of these dangerous diseases are so rare that no one has bothered to develop a cure. Dying from something exotic is probably no more gratifying and

no less unpleasant than dying from something mundane.

Typical means for diseases to get from animals to humans include insect bites, or contact with animal saliva, urine, or feces. Avoid these things. Some insects, such as the ticks that carry Lyme disease, may drop onto you from plants -- it helps that we usually observe in clear, open areas -- but being close to an animal increases risk of disease spread by other means. Unpurified water is a source of a vast number of unpleasant things -- don't let it get near your mouth.

Animals that died recently are special hazards. Their parasites will seek new hosts, and if you pass within flea-jump distance, that's you. When I took mammalogy, we were told not to get closer than the length of a long shovel to a dead ground squirrel -- the shovel is to bury it -- because ground squirrels are the primary carriers of plague -- the Black Death -- in California. Modern antibiotics knock plague over, but if you get it in your respiratory tract you may get sick too fast to treat: Pneumonic plague can kill less than six hours from onset of symptoms.

Avoid animals that are obviously sick. A creature so sick you can get close to it is likely so sick that you shouldn't. Weird behavior sometimes indicates illness -- perhaps rabies -- and in many parts of the world, for animals to approach humans is pretty weird. Yet please remember that in areas where animals are protected from hunting, many have never learned to be wary of people, and may approach out of curiosity, or because they want a handout.

The incidence of rabies, plague, and other diseases, varies hugely from place to place and year to year, and Lyme disease is generally on the increase. Health authorities may know what areas are especially at risk for these hazards, but do be sure to get very recent information.

C. Larger Animals. Large predators are scarce on the central California coast, but a few animals can harm by other means than biological warfare. While observing, or en route to or from sites, I have encountered rattlesnakes, wild pigs, skunks, raccoons, coyotes, bobcats and once, maybe, a mountain lion. All these would like you to leave them alone. If you cooperate, you will likely have no trouble. Cooperating may be hard, however, when raccoons are tearing up your car in search of goodies, so be cautious about what you do with food. Think of it as practice for bears, for when you observe in the Sierra Nevada.

If you observe where large predators occur routinely, learn how to avoid them.

## TWO-LEGGED VARMITTS:

We live in a world where other people are sometimes very dangerous. Solitary astronomers, in lonely places on dark nights, are vulnerable. I don't personally know anyone who has been assaulted while observing, but I do know an observer who was dismayed to find that one of his favorite dark-sky spots was within a few score meters of where a notorious serial killer left some of the bodies of his victims.

I have no panacea for such problems. Some people never observe alone. Some carry firearms. Many sites I favor are unobtrusive -- out of sight of public roads and such. Several sites I use have gates that I can close and lock, and I do.

Someone approaching by car or with a light will probably not be as well dark-adapted as you -- perhaps you should step into the darkness, or into cover, to see what happens. It might help to carry a cellular 'phone on your belt. It is good to make sure someone knows when you are going observing, where you will be, and when you expect to be back.

## CONCLUSION:

I hope I haven't frightened you off, but maybe I have made you think. There are probably a lot of small things that we each can do to make the enjoyment of our hobby less risky. If you have learned a few from this article, I am glad I wrote it.

Clear sky.