

Make a point of personally observing an atmospheric, geophysical, or atmospheric optical phenomenon this semester. Observe the phenomenon closely. Any observation that you personally witness during the current semester, and has a relation to the subject matter of this course is fair game. (Examples include atmospheric optics--rainbows, halos, color variations in the sky, etc., condensation of water, cloud formation, dispersion of pollution, behavior of waves breaking, stream flow, effects of wind on water, climatic effects on landforms, etc.)

Choose a single observation for your subject. Creativity in the choice of your observation and in doing the assignment will be rewarded in the grading. Note points (out of 100) for each part in parentheses below. *The text for this assignment should comprise about three double-spaced pages, with images/figures extra.*

**Requirements**

1. Describe the setting of your observation, including date, time, place, and any circumstances which contribute to the phenomenon (**note: this observation must occur during this semester**). Provide context for your observation by including weather maps, a sounding, and/or satellite views for the date/time of your observation. (see <http://mkwc.ifa.hawaii.edu/archive/index.cgi> for archived images) (20)
2. Describe the phenomenon in detail. Pay careful attention to detail. Use of your creative writing abilities is encouraged. (20)
3. Illustrate the phenomenon or a relevant aspect of the setting or physical mechanism(s) involved with a photograph or video clip. Digital photographs are preferred and the assignment can be emailed to me at [businger@hawaii.edu](mailto:businger@hawaii.edu). Cell phones sometimes take poor photos (blurry), which will result in a discount in the grading. Composition/creativity in photography and beauty in the image will be rewarded. (30)
4. Give a concise explanation of what physically is producing the phenomenon. Refer to the text for this part of the assignment. Schematic illustrations and/or images from the web should be used as part of the explanation of the phenomena you photographed. (30)

*Include a caption for each photo and figure and be sure not to include redundant text from the caption in the body of the paper.* The more specific your choice of observation, the easier it will be to fulfill each of these four parts above. The resulting assignment should be one double-spaced typed page, not including embedded photos and images. But, also attach your photo separately at highest resolution. Label all files with your last name so I know who they are from without having to open files. And then when they are due, please email them to me.

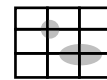
## ***SKY PHOTOGRAPHY***

In this short essay I will discuss several of the keys to becoming a good sky photographer and capturing striking images.

*Key number one:* The most important ingredient in becoming a successful photographer of the sky is keeping a camera with you. In recent years this has become easier with the arrival of lighter weight digital cameras and more recently decent phone cameras. Many professional photographers prefer single-lens reflex cameras, in which metering and composing are achieved through the lens. However, publishable photographs can be obtained with modern point-and-click models. It can be awkward carrying a camera with you everywhere you go, but as soon as you decide to leave it behind the best rainbow or most dramatic sunset you have ever seen will appear (Murphy's law). Sometimes it's not enough to have a camera close at hand; you also need memory card and a live battery. If you are interested in selling your work, it is useful to note that many markets prefer digital files larger than 6 mb for better resolution. Slower ISO speeds ( $\leq 200$ ) give finer grain resolution and provide the best results in bright daylight conditions. Indoors and in the evening higher ISO settings ( $> 800$ ) will keep the image from blurring. The highest ISO setting will result in more noise in the image. Most cameras automatically set the ISO.

*Key number 2:* Keep an observant eye. Make a habit of searching the sky whenever you exit your home, car, office or any building. Many visually striking weather phenomena in the atmosphere are fleeting and often occupy only a fraction of the heavens. Therefore, persistent attention to details of the sky will result in dramatic images. Sometimes the brightness of the sun and our healthy tendency to avoid looking towards it causes us to miss some of the most beautiful displays of atmospheric optics (e.g., halos, iridescence or coronas) produced by a variety of thin clouds close to the sun. In looking for such phenomena cover the sun with your extended hand and use of a good pair of sunglasses to protect your eyes from the sun's harmful rays. Then use a tree branch, light pole, or other object to block out just the sun, thus allowing for better exposure of the phenomena of interest.

*Key number 3:* Careful composition is the third key to good sky photography. Try to balance the areas of the photograph. To make your compositions more balanced and compelling, divide the viewfinder into thirds in your mind. Then place the subject or focus of



your photograph at one of four resulting points of intersection. Choose the foreground of your sky photos carefully. For example, reflections of the sky in a lake or pond can give added interest to the foreground and create dynamic images. Similarly, the use of tree branches to frame a special cloud can add interest to an area of an image that otherwise

lacks detail. On the other hand avoid clutter, such as telephone wires, that distract from your subject.

Choose the right lens to show the subject to best advantage. Telephoto lenses are great for isolating areas of special interest in the sky. A strong telephoto is needed to capture a good example of a mirage or the fleeting “green flash” as the sun sets over water. Similarly, the best lens for catching halos and rainbows is a wide-angle lens. To photograph an entire double rainbow requires a 90°-viewing angle. Photo software now allows you to stitch together two images into one panorama shot.

*Some hints for taking special photos:* Despite its fleeting nature, good photographs of lightning are surprisingly simple to obtain provided you approach the subject with caution and a bit of patience. On the next stormy night, choose a protected place (e.g., inside a car) and place your camera on a sturdy tripod (or sand bag) to steady it against jarring from the wind. Select the shutter speed setting that allows the lens diaphragm to remain open while the shutter release is depressed (use the “b” setting for the shutter speed selection in cameras with manual override). Then press the shutter release and wait. Once a bright flash of lightning is observed through the viewfinder let go of the shutter release. The lightning will expose the camera charge coupling device (CCD) chip much as a flash bulb would. To get a really “striking” image leave the lens open for the duration of several lightning strokes.

When shooting halos and coronas that surround the sun you must point the camera directly at the sun. Contrary to intuition, shooting into the sun does not harm your camera, but will often result in underexposure of the subject you’re trying to capture. To avoid this problem it is advantageous to block out the sun with an object such as a treetop or flagpole, and if your camera allows, spot meter the subject for correct exposure. When shooting near the sun, shade the front of the lens to eliminate reflections that are internal to the lens (resulting in those artificial hexagonally-shaped flares in the photos).

*Some special cautions:* Weather phenomena that inspire great awe such as tornadoes and hurricanes must be approached with extreme caution, and are perhaps best left to professional meteorologists. Hurricanes in particular make poor subjects to approach, not only in the threat that they represent to your health, but additionally your presence can interfere with critical emergency evacuation, rescue and relief efforts.

*Parting shot:* On your next excursion do pack a camera, and keep your eyes to the sky. You will be rewarded for your persistence and patience in more ways than just good photography. Happy hunting, Steven