PREDICTING AUREOLES AND CORONAS Since aureoles and coronas are associated with thin altostratus and fogs, knowing when and in what conditions they occur can give us a heads-up for possible sightings.

If over the period of a day or so, you note high cirrus that thicken and lower, the next likely cloud pattern to form is altostratus, as the layer of air continues to sink and clouds condense. As a mainly featureless grayish or bluish cloud sheet, having parts thin enough to reveal the Sun at least vaguely, altostratus offer the uniformly small droplets conducive to coronas.

The most common fog forms overnight in still, moist air as the Earth radiates heat and the air cools. Called a radiation fog, it occurs most frequently in valleys where cool air accumulates after draining down hillsides. Another type of fog forms when moist air flows over a cold surface, as it does at sea. As long as the fog is not too dense, and the light from the Sun or Moon can penetrate it, look for a corona.

INTERPRETING AUREOLES AND CORONAS

A ring around the Sun or Moon
Means that rain will come real soon.

The appearance of a corona or aureole is the unmistakable tip-off to the presence of moisture in the air. When that form of moisture is a bank of altostratus, it may, in turn, be an indication of the approach of a warm front, which could bring precipitation within twenty-four to forty-eight hours.

RAINBOWS

Aristotle was perhaps the first deep thinker to ponder the rainbow's arc, and the person who confidently but wrongly attributed it to the rain's reflection of the Sun's rays. René Descartes, in 1637, tackled the enigma by simplifying his study to one droplet and how it interacts with light. Experimenting with a large water-filled glass globe as the droplet's substitute, he fairly accurately described the rainbow's basic mechanics.

The familiar spectral arc of the rainbow is produced by refraction and reflection inside individual raindrops falling in a sheet, and comes in several varieties. For a rainbow to occur, the Sun must be shining in one portion of the sky, and rain falling in another portion. For a rainbow to be observed from the Earth's surface, the Sun must be at the observer's back, and the rain in the opposite direction.

As light enters a raindrop, it refracts, separating into its spectrum colors, bending shorter wavelengths (violet) more than longer wavelengths (red). If the angle between the refracted light and the inside back surface of the raindrop is less than 48°, the light simply passes through the back of the drop, refracting once again upon exiting. No light is received back to our eyes and nothing is observed. (This angle is called the critical angle for reflection in water—it is different for other substances.) If the light strikes the back of the drop at an angle greater than 48°, light is reflected back. The reflected light is refracted as it exits the drop, again bending violet light more than red light, resulting in an approximate 2° dispersion of color between about 40° and 42° relative to the incoming sunlight, and we observe the arc of the primary rainbow, with red on the top or outside of the arc, and violet on the bottom or inside of it.

The primary rainbow may be thought of as a cone of concentrated light bounded by spectral bands. The arc is always centered on the antisolar point at the head of the observer's shadow, 180° from the Sun. Light passing through drops inside the cone brightens the sky inside the cone; light passing through those outside do not. To witness the complete ring, we must move to a height above the rainfall, thus lowering our horizon.

Light entering at the top of a drop is refracted, reflected off the inside back surface, then refracted again as it exits the drop, having been bent a total of about 138°. Light entering near the bottom of a drop refracts, reflects twice internally, then refracts upon exiting the drop, having been bent a total of about 231°. The differing color sequences between the primary and secondary bows are produced in the same way: Violet is bent more than red.

Each drop in the sky produces all the colors of the rainbow, but we do not see them. Instead, only the drops situated at the vertical angles of about 42° and 51° refract their dispersed light toward our eyes. Of that, just one color from each drop is deviated at just the right angle for us to see, and thus is only a fraction of the total bow observed. Higher drops collectively contribute to the secondary bow; lower drops to the primary bow. Each person sees his or her own rainbow.

Because of the various angles

RAINBOW CONSTRUCTION