Terwilliger's Physics

presents

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Make-and-Take Workshop

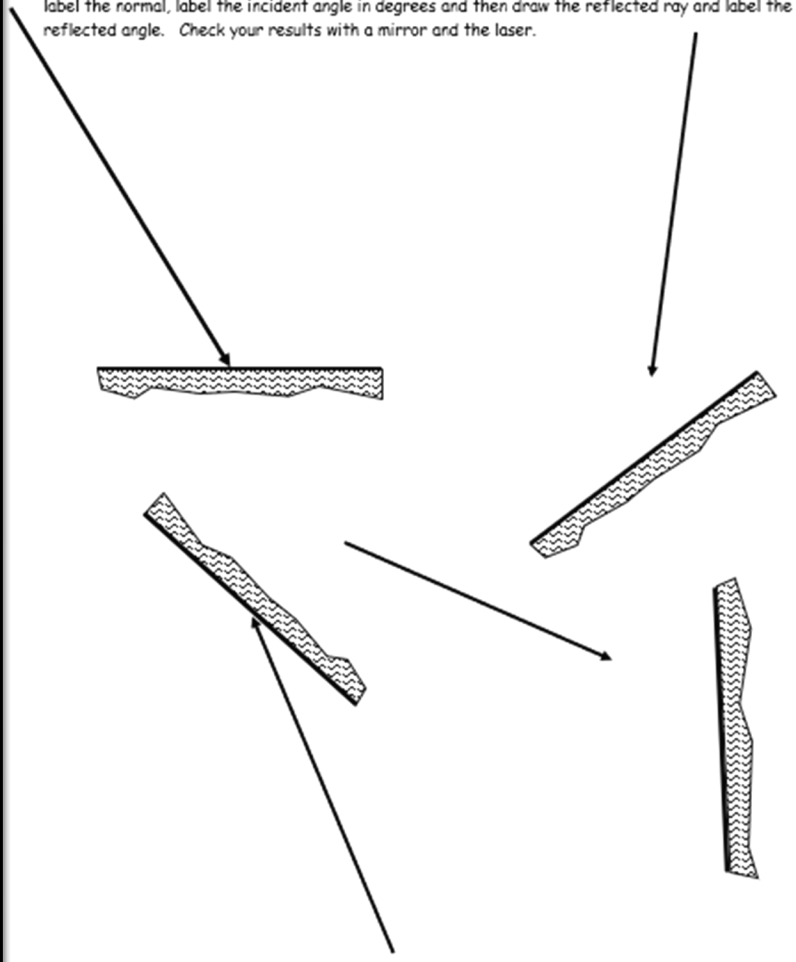
Line Laser

Mirror Lab application

Mirror Lab - Part 1

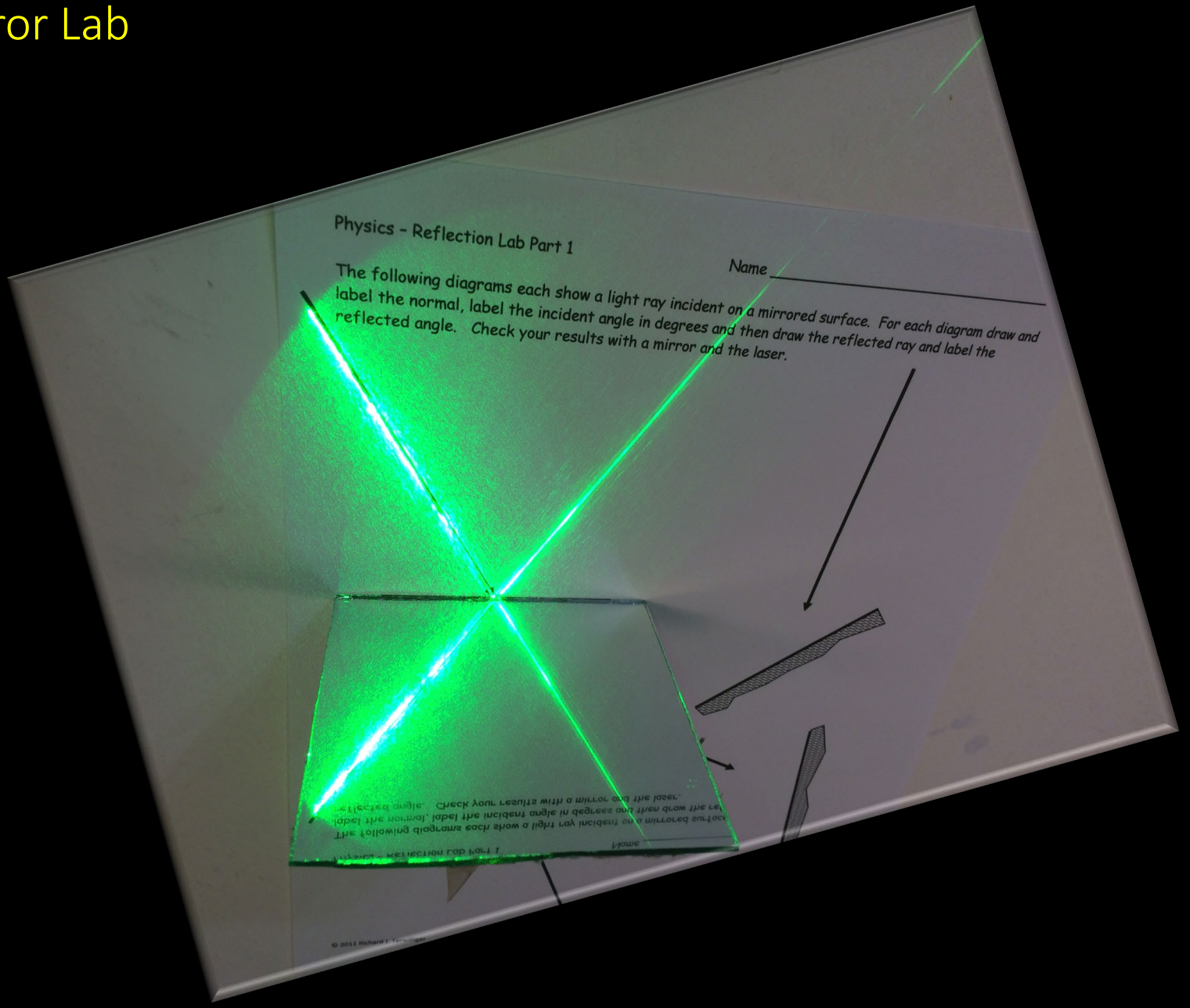
Physics - Reflection Lab Part 1 Name _____

The following diagrams each show a light ray incident on a mirrored surface. For each diagram draw and label the normal, label the incident angle in degrees and then draw the reflected ray and label the reflected angle. Check your results with a mirror and the laser.



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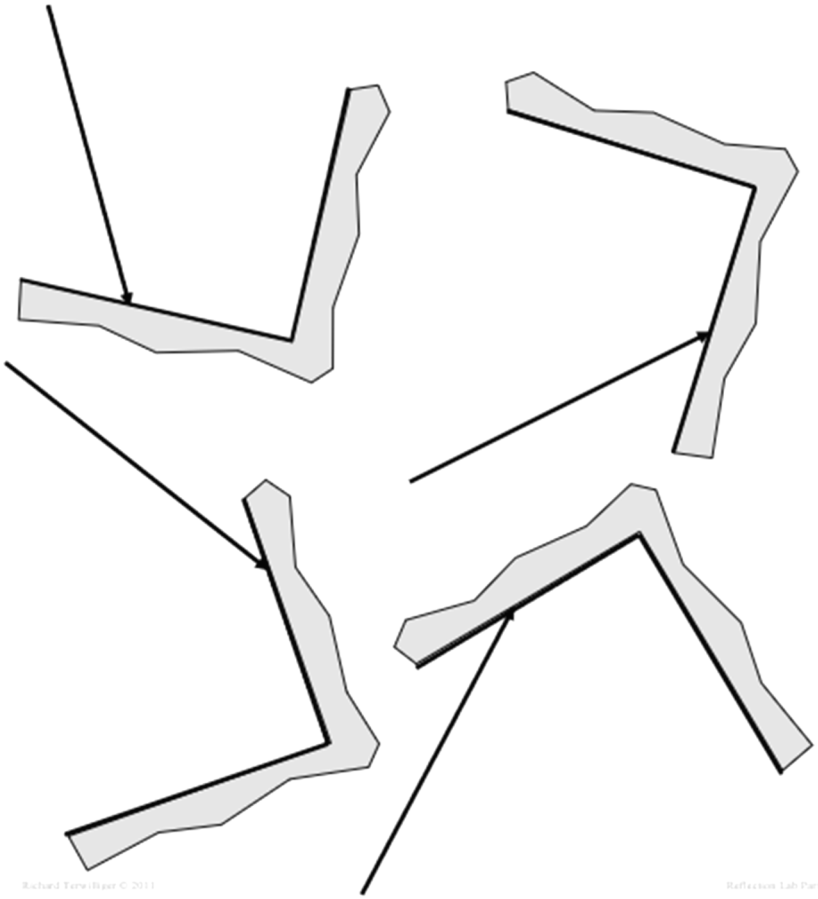
Mirror Lab


Physics – Reflection Lab Part 1
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The following diagrams each show a light ray incident on a mirrored surface. For each diagram draw and label the normal, label the incident angle in degrees and then draw the reflected ray and label the reflected angle. Check your results with a mirror and the laser.

Mirror Lab – Part 2

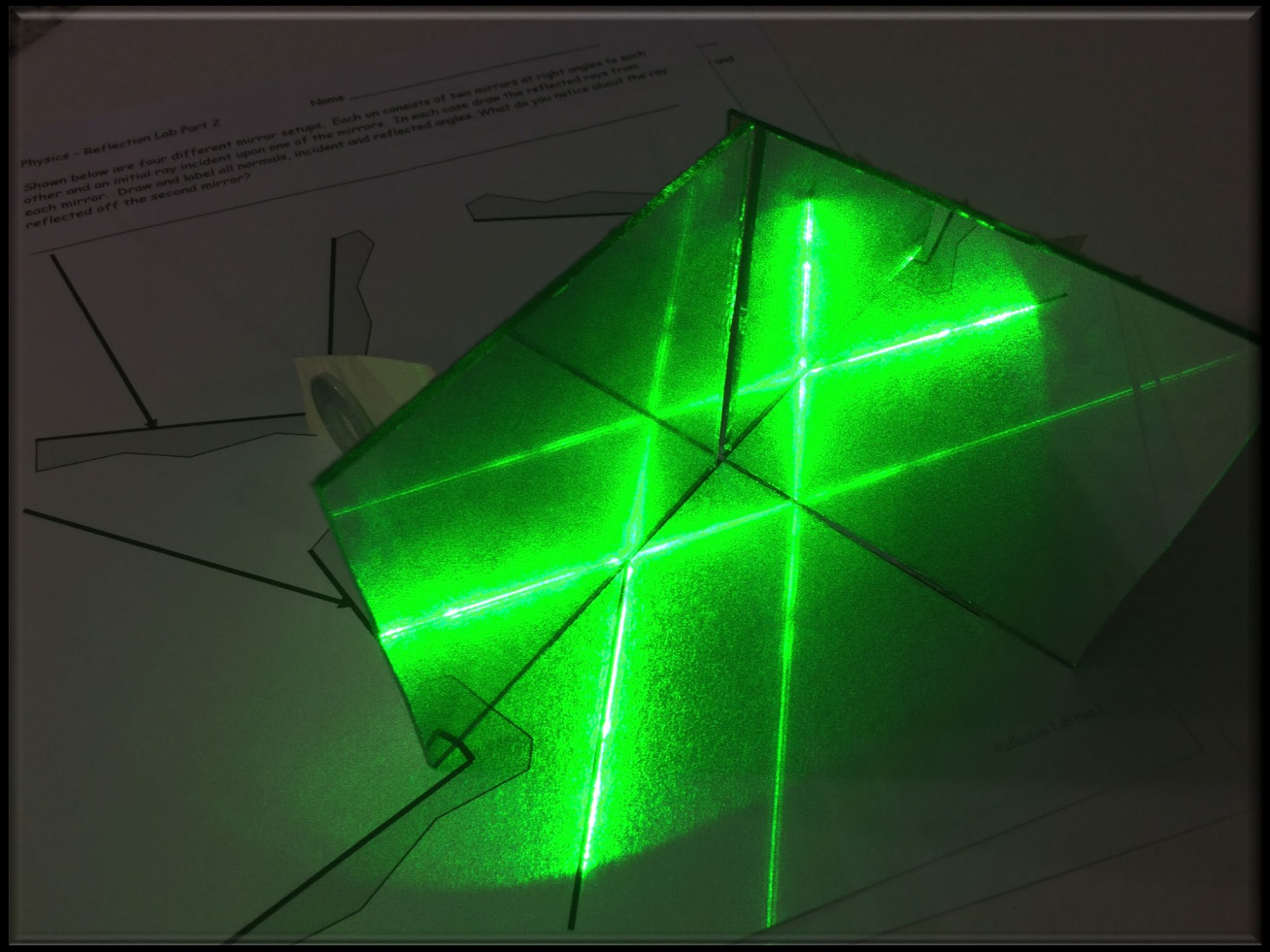
Physics - Reflection Lab Part 2 Name _____

Shown below are four different mirror setups. Each on consists of two mirrors at right angles to each other and an initial ray incident upon one of the mirrors. In each case draw the reflected rays from each mirror. Draw and label all normals, incident and reflected angles. What do you notice about the ray reflected off the second mirror?



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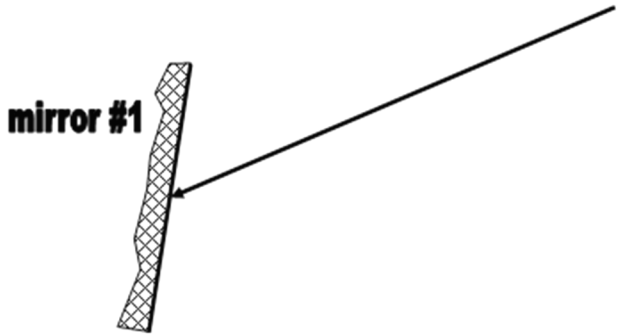
Mirror Lab


Physics – Reflection Lab Part 2
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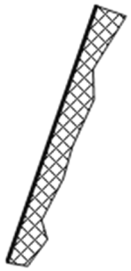
Mirror Lab – Part 3

Physics - Reflection Lab Part 3 Name _____

The following diagrams show light ray incident on a mirrored surface #1. The ray reflects off the mirror and travels to the second mirror, reflects off the second mirror then off the third and then on to the forth mirror that is missing. Determine where to place the forth mirror and its orientation so the reflected ray hits the target. Draw in the position of the forth mirror and then check your results with 4 mirrors and the laser level.



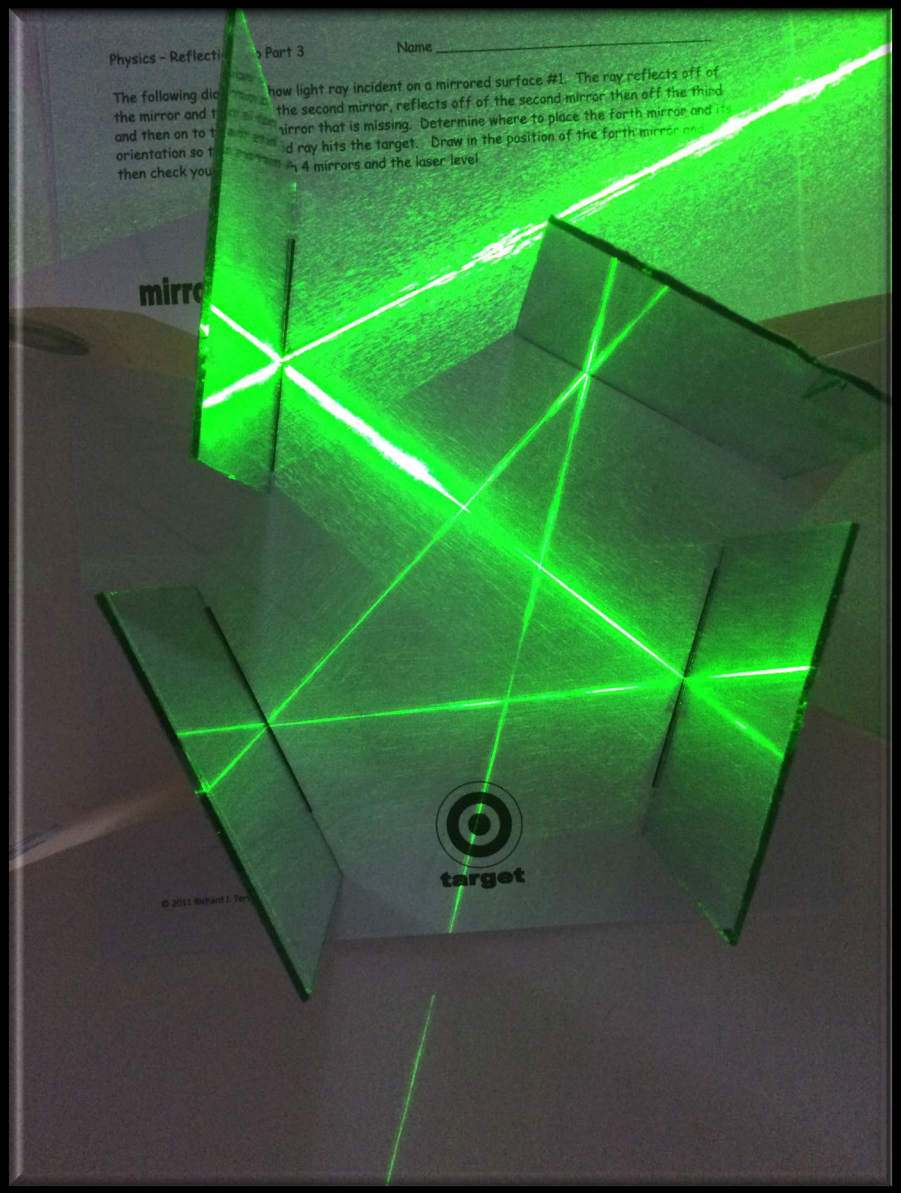






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Mirror Lab

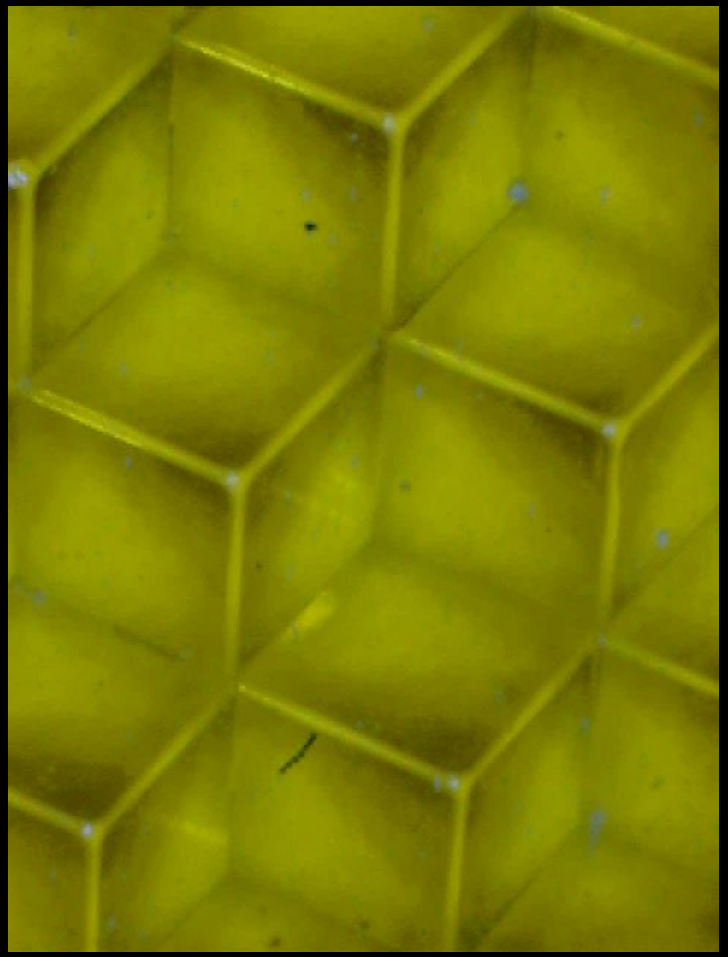

Physics - Reflecti
Part 3
Name
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target

Mirror Lab part 4 – Physics Mirror Race

Bott's Dots

Corner Box





What is this?

Hint: It has to do with reflection.

REFLECTORS

Click to find out.

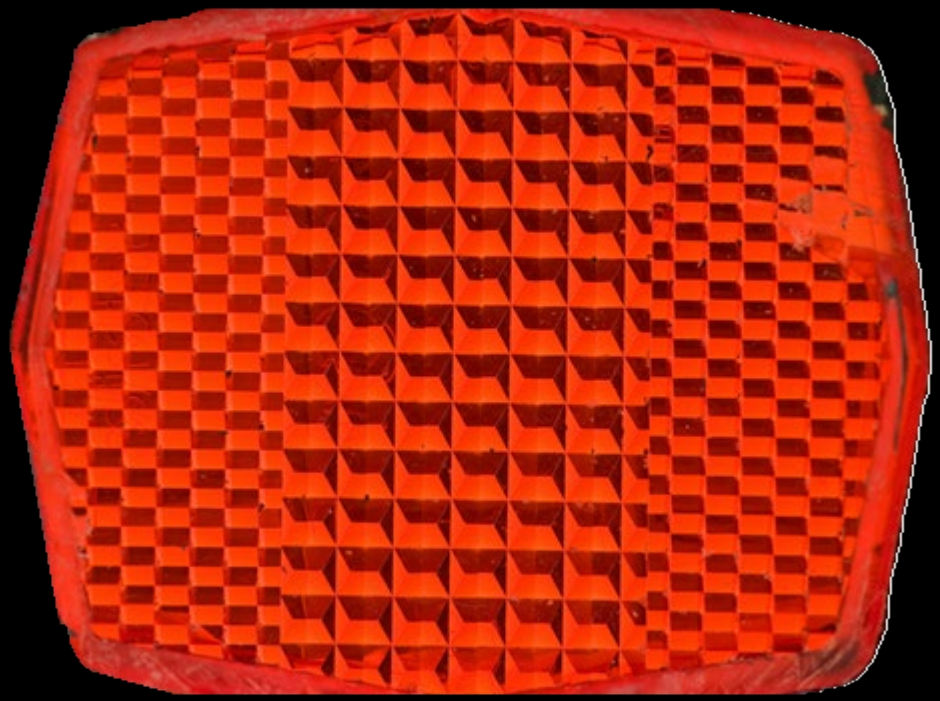
Click

Corner Box

BICYCLE



REFLECTORS



Click

Corner Box





Bott's Dots

CLICK



Bott's Dots

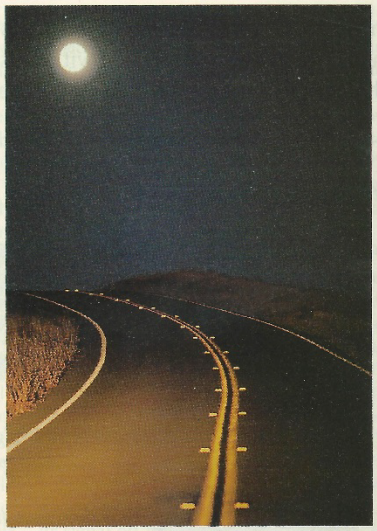


CLICK

Dot Dot Dot

BY MICHAEL LAMM

IT'S SOMETIMES HARD TO TELL when someone has just saved your life. But Elbert Botts has pulled me back from the brink a number of times, and he's probably uncooked your goose once or twice too. Although there are no statues to honor Botts, he has hundreds of millions of tiny monuments to his memory along the world's highways. No one can say how many lives they have saved during the last thirty years, but the total is more, I'd venture, than air bags and seat belts combined.



Botts Dots shine through rain and gloom of night.

Elbert Dysart Botts was born in rural Missouri in 1893 and showed an early interest in the natural sciences. In 1924 he earned a doctorate in chemistry from the University of Wisconsin. He worked for a paint company for three years but then decided that he wanted to teach. In 1928 he became an assistant professor at San Jose State University in California, where he continued his research in paint chemistry. Botts stayed there until 1944, when he became a chemist for the federal government. In 1950 he joined the California Department of Transportation (Caltrans).

One thing Botts was looking for at Caltrans was a paint that would outlast concrete and remain visible on the rainiest and gloomiest of nights. No matter what paints he and his staff tried—some of them even containing tiny glass beads to reflect headlights—there was always the problem of a film of rainwater making the lane stripes invisible.

Botts decided to try reflective pavement markers (RPMs, as he called them) that stuck up above the surface of the roadway. His team soon came up with a glass-and-ceramic marker that a nighttime motorist could see from a hundred yards away. The biggest problem, it turned out, wasn't the markers themselves; it was fastening them to the roadway.

At first Botts tried drilling a hole through each marker and attaching it with a steel spike. That worked pretty well until the spike loosened, whereupon the impacts of automobile tires broke the ceramic marker and left the spike sticking up like a dagger. A former student of Botts named Herb Rooney developed a tough, fast-setting epoxy that could bond the raised reflectors to virtually any solid surface. Testing continued through the late 1950s and early 1960s. Botts retired on January 1, 1960, and died at age sixty-nine in 1962, so he never saw the effects of his work. He never profited from its enormous popularity either; everything he invented for the state went into the public domain.

California's first Botts Dots went into service in 1966 along Interstate 80 in Solano County (northeast of San Francisco) and U.S. Highway 99 near Fresno. One serendipitous aspect of the Dots soon became apparent: They made a thrumming noise when a tire passed over them at speed, as well as a bumping motion that drivers could easily feel. These side effects are every bit as important as their reflectivity on rainy nights—maybe more so.

Botts Dots come in two basic types, reflective and plain. The plain ones are usually round domes, in white or amber, made of a dense ceramic or plastic material. The reflective ones are high-impact polyester and usually rectangular, about four inches square. The most common type reflects white light and is used to delineate parallel lanes. Center markers on two-lane highways and city streets reflect amber. And if you've ever gotten on an off-ramp at night going the wrong way, you've seen the dreaded red Botts Dots. Blue ones are used to help firefighters spot hydrants.

It costs about $3.50 to stick one Botts Dot to the road surface. The job used to be done on hands and knees, but today machines perform most of the work, sandblasting a spot, applying the epoxy, and putting the Dot in place. The epoxy —nowadays actually a bituminous adhesive—sets up within five minutes. Once a Dot is glued down, it will stay in service anywhere from eighteen months to ten years.

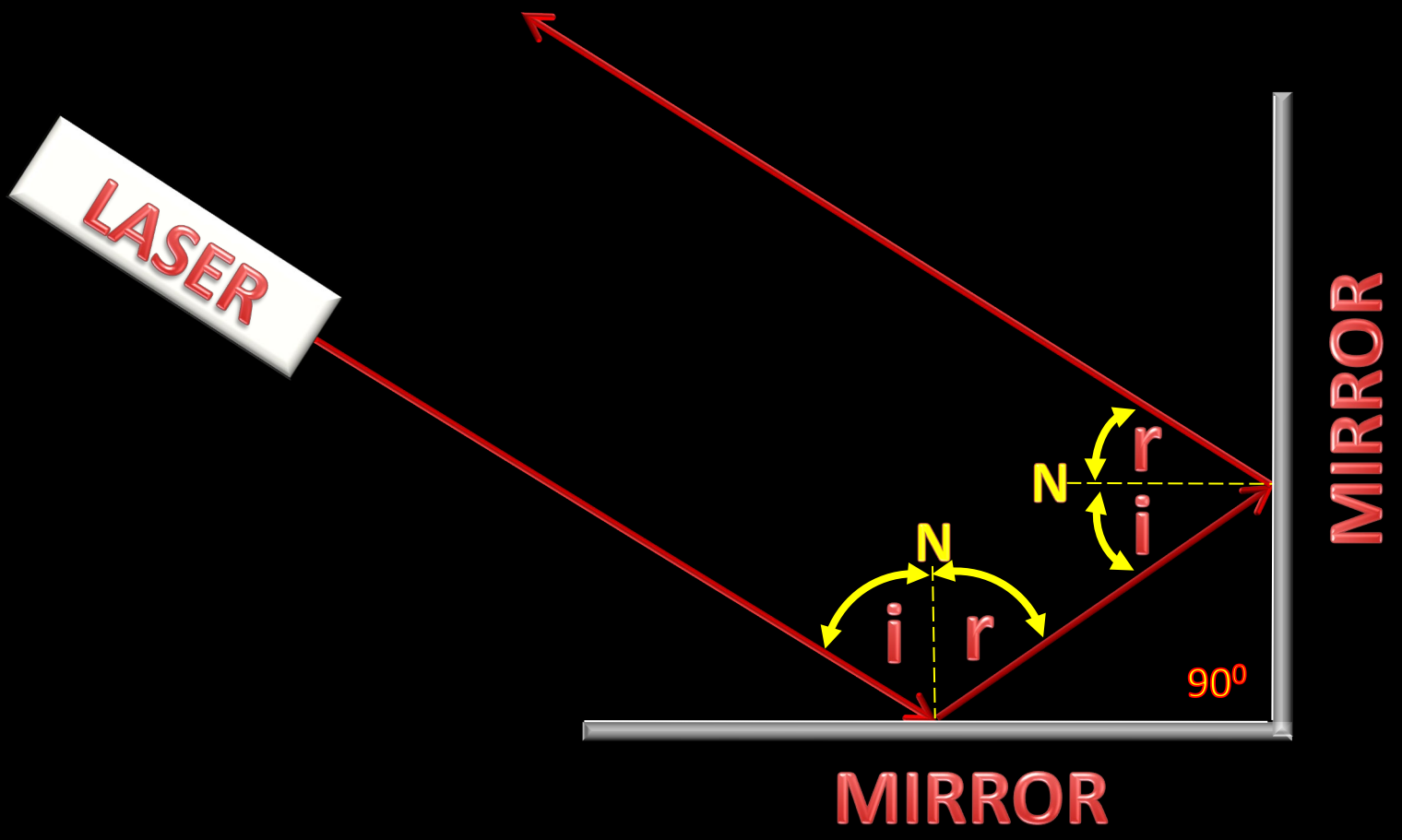
No one can say how many sleepy drivers have been jolted awake by Botts Dots, nor do statistics exist on the number of inattentive motorists snapped back to reality when their tires told them they were wandering out of lane. Factor in the number of nighttime accidents prevented, especially on rain-soaked streets, and you'll get an appreciation for what Elbert Botts left us. ★

Michael Lamm lives in Stockton, California. His book A Century of Automotive Style *was published by Lamm-Morada Publishing Co. in 1996.*

CLICK

Corner Box

Corner Box

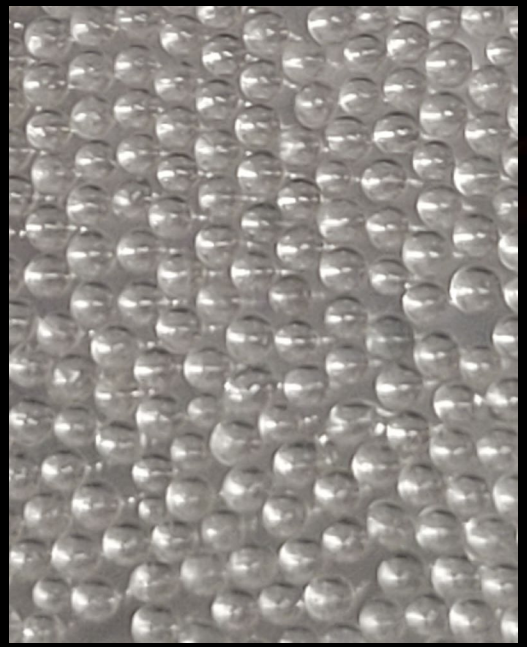


Retroreflection

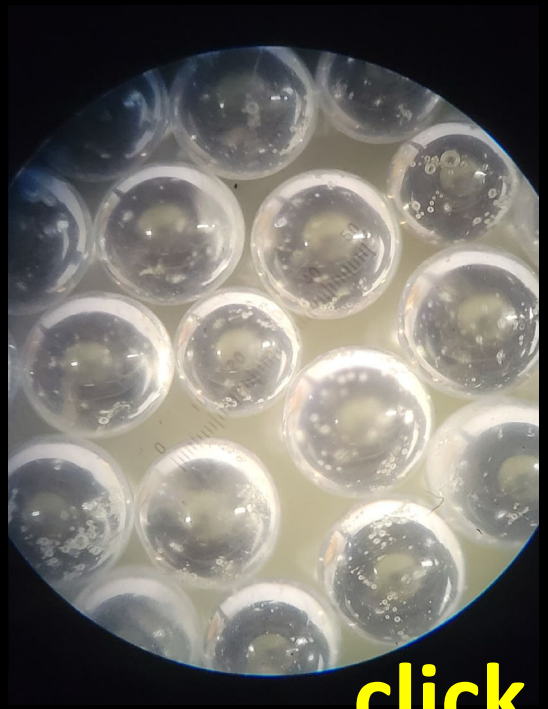
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More Fun Stuff

Road Glass



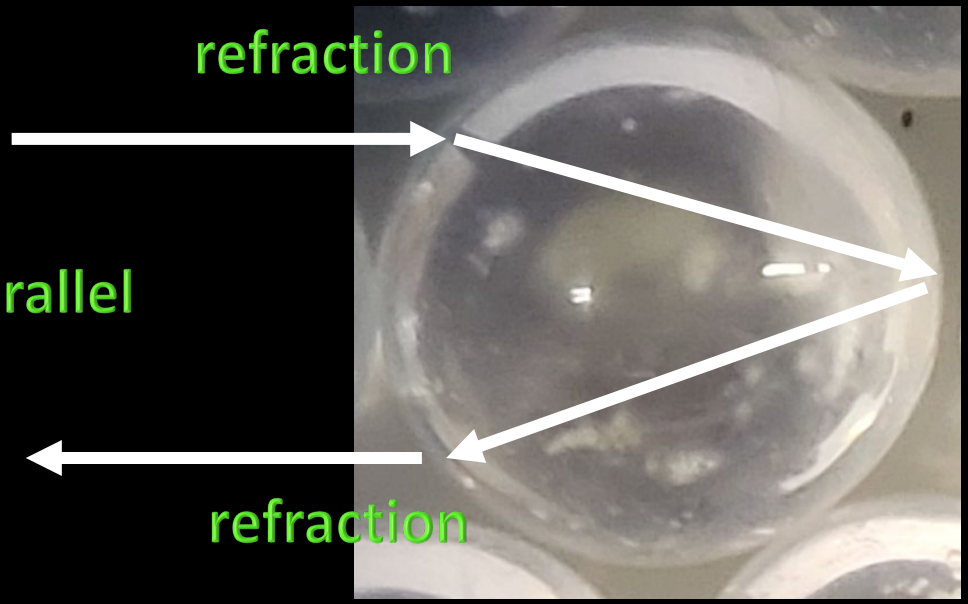




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More Fun Stuff

Road Glass



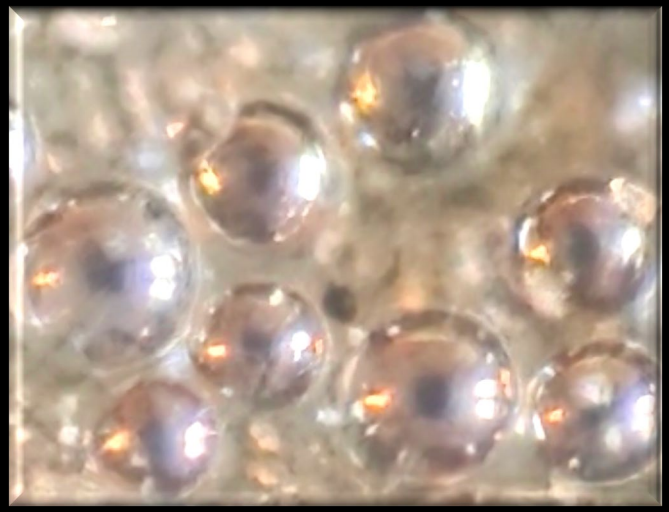
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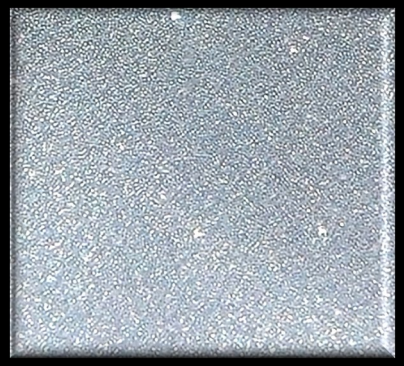


Safety Vests

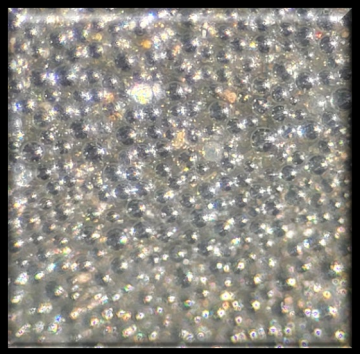












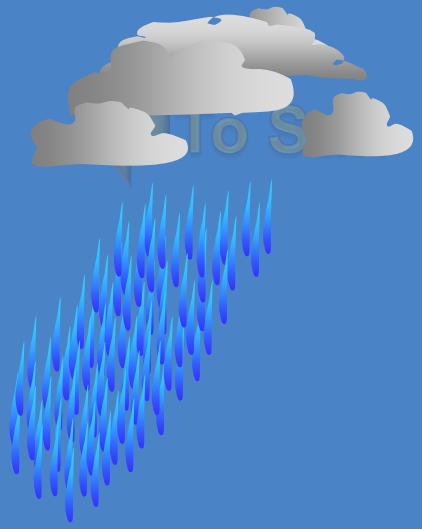
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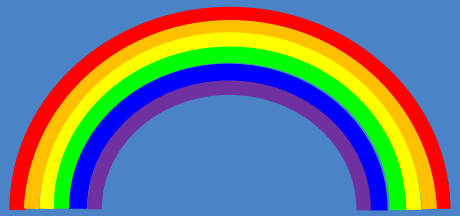
RAINBOWS

are another example of

DISPERSION

Rainbows



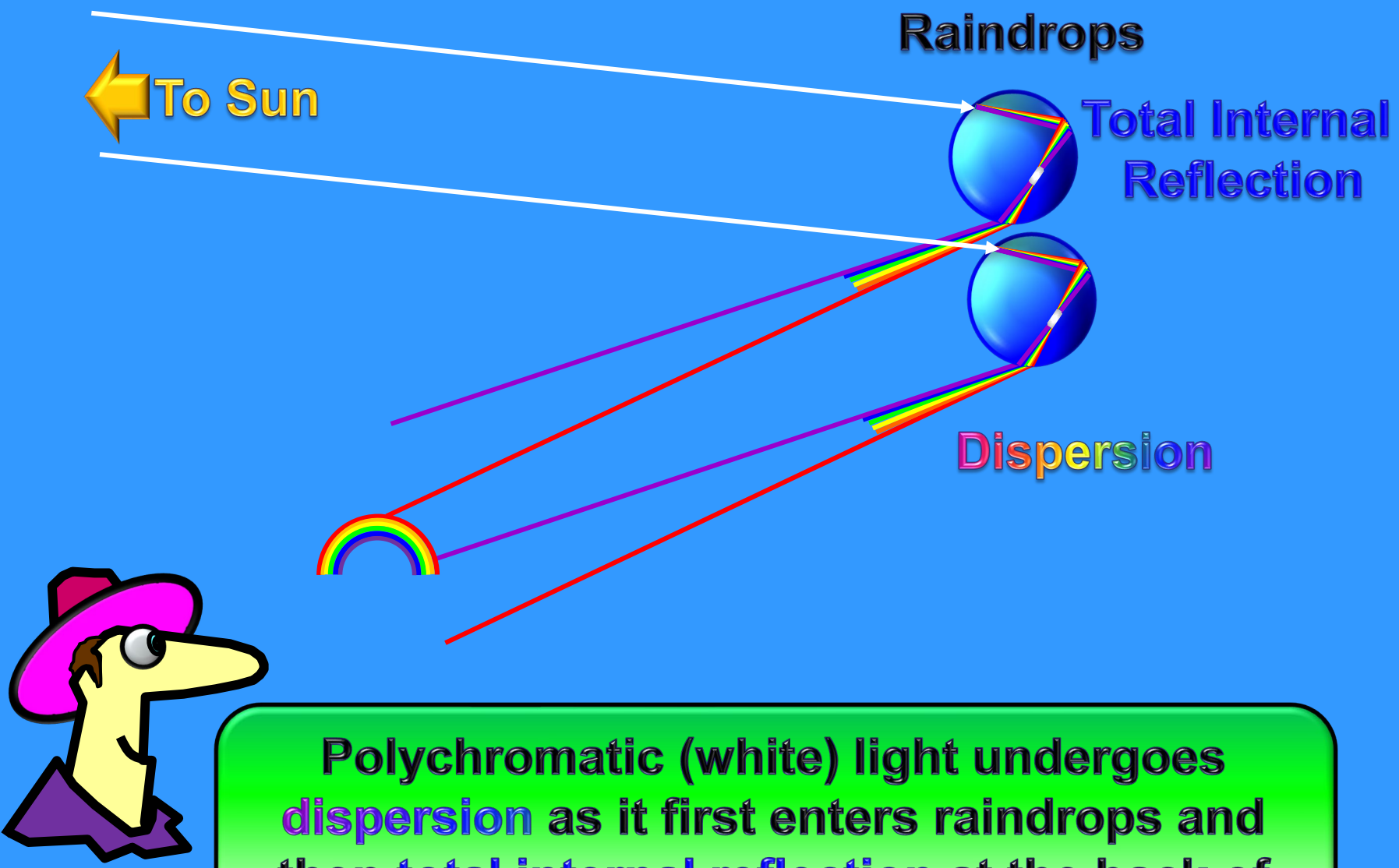




Rainbows usually occur in the mid to late afternoon as a rainstorm passes by and the Sun is lower in the sky.

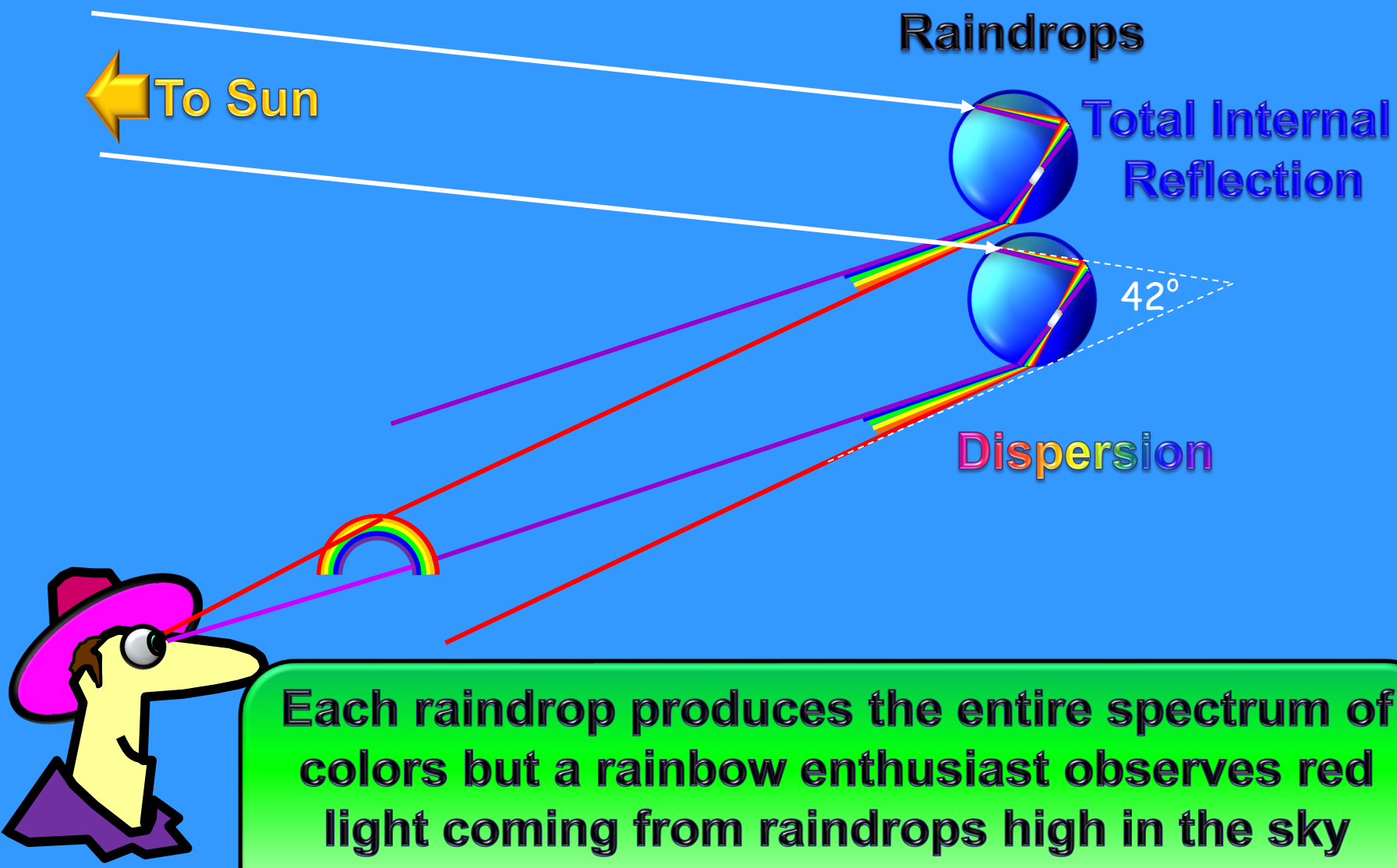
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Polychromatic (white) light undergoes dispersion as it first enters raindrops and then total internal reflection at the back of the raindrop.

click



Each raindrop produces the entire spectrum of colors but a rainbow enthusiast observes red light coming from raindrops high in the sky and violet light from raindrops lower in the sky with all of the other colors in between.

click







Rainbows





BabyBlueAzurite@aol.com



AZURITE

$Cu_3(CO_3)_2(OH)_2$