Litiholo holography – So easy even a caveman could have done it (apparatus review)

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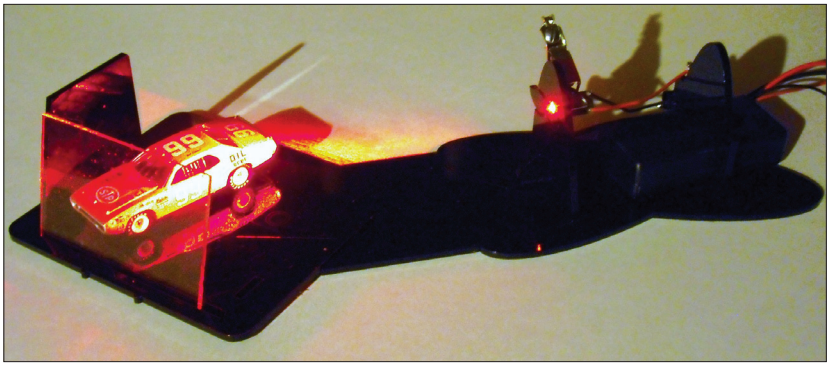

Fig. 1. The assembled Liti Hologram Kit.

Back in the day, making a hologram often required a sandbox for vibration isolation, a fairly powerful and relatively expensive laser, beam splitters, some front surface mirrors and perhaps a lens or two, and developing chemicals. The equipment and conditions necessary to successfully produce a hologram put holography beyond the means of most precollege teachers and their students. Thankfully, things have changed.

For well over a decade, it has been possible to make holograms with relative ease and at moderate expense. Gone is the need for the sandbox and high-priced lasers. Low-power, inexpensive laser diodes and inventive logistics make it possible for students at virtually all grade levels to produce their own holograms safely and inexpensively.

Much of the credit for making holography accessible and safe goes to Lake Forest College Professor Emeritus and recipient of AAPT's Robert A. Millikan Medal Tung Jeong. His tireless efforts have made it possible to engage students in the study of optics through the exciting field of holography. Now Jeong's pioneering advances have been taken one step further by Liti Holographics.

One of the things that may have prevented science teachers and parents from having their students get involved with holography was the chemistry needed to develop the holographic film. This is no longer a problem. "Litiholo,"[1] a division of Liti Holographics, has revolutionized student-friendly holography by coming up with a self-developing "Instant Hologram" film, making the production of holograms possible without the use of developing chemicals. And because the active components in the film are consumed during exposure, the film is no longer sensitive to light after exposure. As a consequence, the film is ready for viewing immediately after exposure.

Another positive aspect of the Litiholo film is its ability to "forgive" the presence of a moderate amount of ambient light during exposure. The film requires approximately five minutes of illumination with laser light for saturation. As a result, the film is relatively insensitive to light that might enter a room as a result of a door being opened momentarily.

The Litiholo Hologram Kit comes with everything that's needed to produce transmission holograms: A 5-mW, 633-nm laser diode, 20 2-x-3-in Instant Hologram film plates,[2] a blue LED darkroom light, batteries, a battery holder, and even a toy car for use as an object. Also included in the kit are three interlocking plastic pieces that support the laser and film and hold the laser and film plate in alignment. These precision laser-cut pieces virtually eliminate relative motion between laser and film, thus increasing the chances for success.

Assembly of the hologram kit is very simple. It consists of fitting together the laser mount, holographic plate holder, and spacer—the three pieces of plastic mentioned previously. After inserting the laser diode in the laser mount and connecting the leads from a battery pack to the laser, you're ready to make a hologram.

Before an unexposed film plate is taken out, a cardboard shutter is placed in front of the laser. The laser is then turned on and allowed to stabilize for five minutes. Once an object, such as the toy car shown in Fig. 1, has been selected and placed on the designated spot on the plate holder, its time to turn off the lights, take out an unexposed film plate, and place it in the slot on the plate holder. A wait time of three minutes is suggested to allow small vibrations to damp out. The shutter is then removed for five minutes and replaced. The hologram is now ready for viewing, which is accomplished by looking through the film plate after removing the shutter and object.

Transmission holograms require the use of a laser for viewing. Since students will most certainly want to share their holograms with family and friends, *reflection* holograms, which can be viewed with white light, may be preferable. For an additional $34, a reflection hologram upgrade kit is available. The kit includes a "laser tower" and spacer designed to properly position the laser for making reflection holograms. As a bonus, 10 Instant Hologram film plates are included with the upgrade kit.

This reviewer has found that while viewing the reflection holograms with laser light produces the best results, illuminating the holograms with a flashlight, sunlight, or spotlights found in track-lighting systems also works well.

I've produced both transmission and reflection holograms

using the Litiholo kit, over a dozen in all, without a failure. I've also included optical elements such as lenses and mirrors in my holograms and produced a holographic diffraction grating.

To see just how closely the prescribed production procedure has to be followed, I intentionally bent the rules on occasion. I varied the exposure time, allowed some light into the room, and even introduced a small amount of vibration. To my surprise, and delight, I always had at least a modicum of success.

While the Litiholo Holography Kit may not meet the needs of experienced holographers, the system will allow parents and teachers to bring the magic of holography, and the science behind it, into their homes and classrooms. As has been mentioned, even with the relatively small film plates, much experimentation is possible…and all without chemicals and the need for ideal conditions. Who could have ever imagined that making a hologram could be so simple?

1. Litiholo, a division of Liti Holographics, 300 Ed Wright Lane, Suite C, Newport News, VA 23606; 757-873-6460, info@litiholo.com.
2. Additional film plates may be purchased in packages of 20 for $64.

YouTube Physics

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A potpourri of practical (or not) projectiles

My high school physics teacher said that there were three ways to keep your students engaged: blow something up, hurt yourself, and run the film backward. In today's educational climate, I might suggest an addition to the list: find videos that show practical applications of physics for them to analyze. In that vein, and with the assistance of a few readers, I put together a smorgasbord of projectile videos. These videos can spark great discussion and even some calculations. Could these videos be real? Let your students be the judge!

1. *Dude perfect – airplane shot:*

In this video (created by Chevy) a group of young men plan and execute a basketball shot from a plane. With a few assumptions, students can calculate either how far before the basket the ball needs to be dropped.

2. *Blob launch (by crazydude507):*

The Blob is a huge inflated balloon that floats on top of the water. One person sits on the edge of The Blob while another jumps from a platform onto the other side of The Blob. The result is a nice projectile launch. Using a stopwatch, the projectile motion can be timed, maximum height determined, and velocity with which this individual will hit the water calculated.

3. *Kobe Bryant jumps over Aston Martin*

The Aston Martin is driving and Kobe waits in its path. At just the right time, he jumps into the air and lands after the car has passed. With a little research on the height and length of an Aston Martin and Kobe's vertical, your students can analyze this video.

4. *Speed clip #2 and Speed 1994 (making of the bus jump).*

The first is the classic video of the bus jump from the movie "Speed." It is interesting to notice that when the gap in the bridge is shown from a distance, there isn't any upward angle. How can a bus "jump" a gap with no change in height when launched horizontally? The second does a great job of showing that the bus they filmed actually had an initial upward angle. I would show the second video after a class discussion.

Special thanks to Frank Noschese, John Jay High School, and Karen Boone, Hallettsville High School. If you have a favorite video, please send the link and a brief description to: Diane Riendeau at driendeau@dist113.org.

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