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A laser spirograph for under \$3 (laser not included)

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A Laser Spirograph for Under \$3

(Laser Not Included)

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Have you ever seen a laser light show at a concert or planetarium and wished you could produce similar laser light effects for your students? While a variety of arrangements may be used to produce spirograph-like patterns with a laser, many use scanning devices that are priced beyond the means of most schools. Ballegeer et al.¹ describe a device that employs mirrors driven by two galvanometer-type scanners to control the motion of a laser beam. Emulating an oscilloscope, this arrangement may be used to project dazzling Lissajous figures. When the device is connected to the right and left channel outputs of a stereo amplifier, music may be used to generate intricate patterns. The scanners, which have an angular deflection that is approximately proportional to the input signal voltage, cost over \$250 each.

If you already own a laser, an inexpensive, albeit less sophisticated, laser spirograph may be constructed for around \$3.² The device consists of two small first surface mirrors attached to two dc motors. The beam from a laser strikes one mirror, which then deflects the beam to the second mirror. After the second reflection, the beam is projected on a screen. The beam thus follows a Z-shaped path. When only one mirror is rotating, a circle or ellipse is produced. When both mirrors are spinning, a large assortment of beautiful shapes can be generated. Triangles, stars, concentric circles, and spiral patterns are just a few of the designs that result from varying the motors' speeds. Reversing the polarity of one of the motors gives rise to a second set of patterns.

In the arrangement shown in Fig. 1, two inexpensive dc motors from Radio Shack are used.³ These motors are rated at 3.5 to 9 V and are perfectly suited for use in this

apparatus. When connected to variable dc power supplies, the speed of the motors and the patterns produced can be controlled easily.

Attach two small (2×2 cm) first surface mirrors to 1.5 cm-long pieces of 2.5-cm dowel rod.⁴ (Note: The pieces of dowel need not be cut with great care. In fact, it is necessary that the mirrors be mounted at a small angle with respect to the motor shaft if circles and ellipses are to be produced.) Drill holes with slightly smaller diameters than the motor shafts in the centers of the pieces of dowel. Friction is sufficient to keep the mirror/dowel assemblies on the motor shafts.

Although the patterns produced with inexpensive dc motors cannot compete with the complexity of scanner-generated art forms, the patterns produced

with this type of unit are simply beautiful! It is unlikely that either you or your students will find them disappointing. Next time you introduce the laser to your class, why not do it with your own laser light show! ♦

References

1. D.J. Ballegeer, J.E. Drumheller, L.D. Kirkpatrick, and M. Rugheimer, "A laser spirograph," *Phys. Teach.* **20**, 415 (1982).
2. This device is based on a design described in "101 Ways to Use a Laser" available from Metrologic Instruments, Inc., 143 Harding Ave., Bellmawr, NJ 08031.
3. Radio Shack dc motors, catalog number 273-229, were used in this device. The motors come in a package of two for \$1.49. Any small dc motor will certainly work as well.
4. The mirrors can be successfully attached to the dowel rods with both hot glue and construction adhesive. However, since no adhesive is foolproof, students should not stand next to the apparatus while the mirrors are rotating.

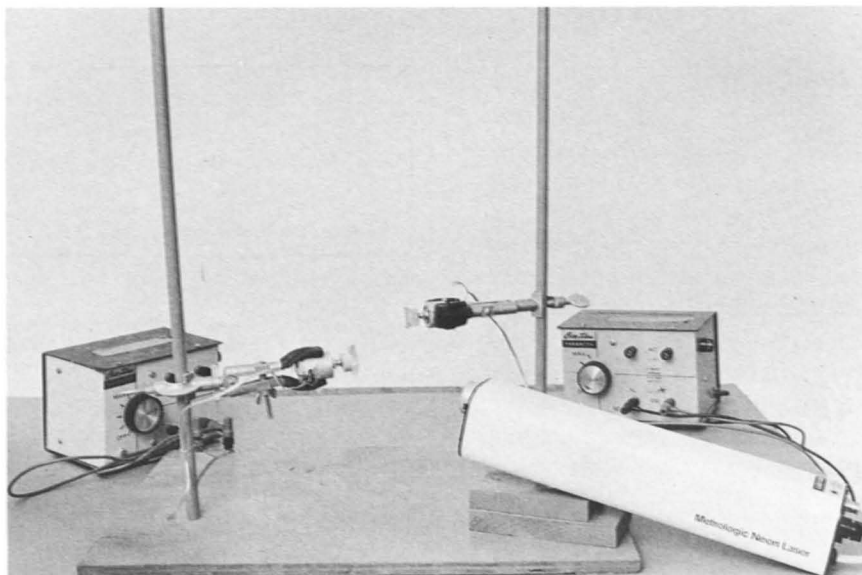


Fig. 1. This inexpensive laser spirograph consists of two small first surface mirrors attached to two dc motors.