

# Micro LASER Show with a CD Lens Mechanism

by [linefeed](#) on July 27, 2008

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## Intro: Micro LASER Show with a CD Lens Mechanism

Hello!

This is the cheapest and easiest way to make a two-dimensional laser show projector.

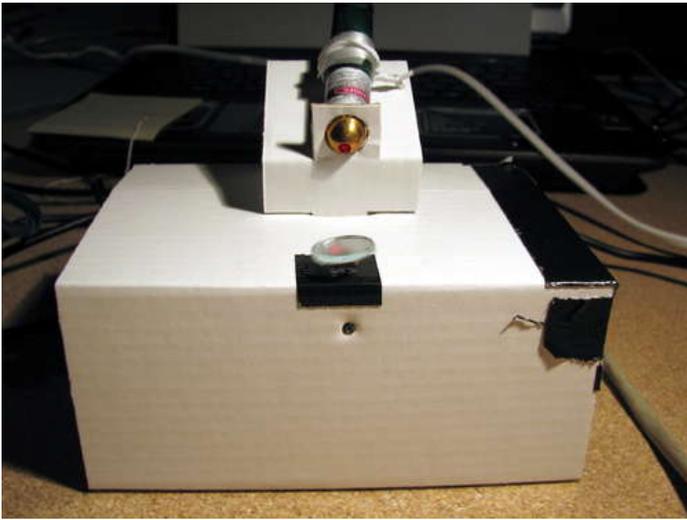
It uses just one pivoting mirror, powered by the focusing mechanism from a CD or other optical drive.

They said it couldn't be done, but [Ljudmila](#)'s skunkworks GRL research facility delivers anyway! ;) This design was first discovered in 2006 and [sucessfully made](#) by several beginners at [the Laser Tags workshop](#) in 2007.

I hope this Instructable, my first, will help to spread it around and let all of you make, test and improve it!

Here shown using an [Arduino](#) for control, but you could hook some other signal into it easily, from a music player, a soundcard or some other electronic circuit.





### Step 1: Gather materials and tools

You will need:

#### Materials:

- a broken CD-ROM, DVD or other optical drive (you only need the lens focusing mechanism, so you get lots of other cool parts left over)
- a LASER pointer of your choice (those small chinese ones will do fine too)
- the smallest and thinnest mirror you can find. we used small round mirrors meant for making mosaics. (bill buxton recommended trying mylar.) you can also use the very small mirror found inside the optical assembly of a CD drive (under the lens, sitting on an angle)
- a short piece of stiff wire (cut off leg of LEDs work for this)
- some soft wire for signals
- a stable housing - some kind of plastic box. bonus if it's transparent
- signal source - I recommend an Arduino as it's easy to use and program

#### Tools:

- cross head screwdrivers, small and very small
- soldering iron for electronics
- wire cutters
- glue gun (or other glue)
- sharp pin for making a hole
- pliers can come in handy



## Step 2: Extract lens actuator from the drive

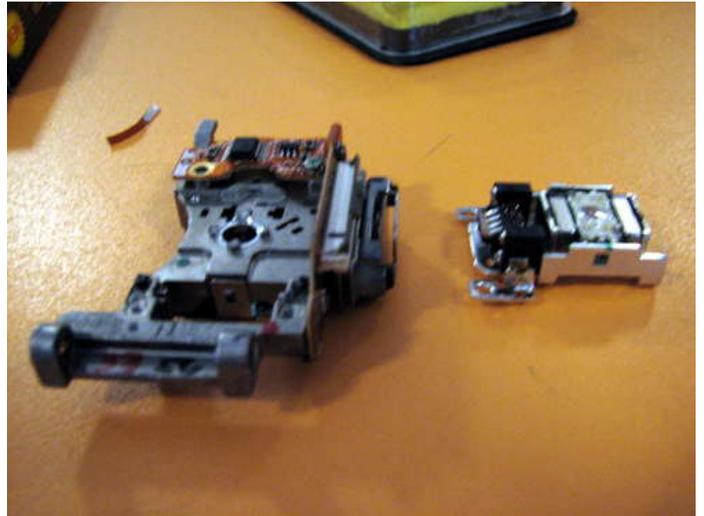
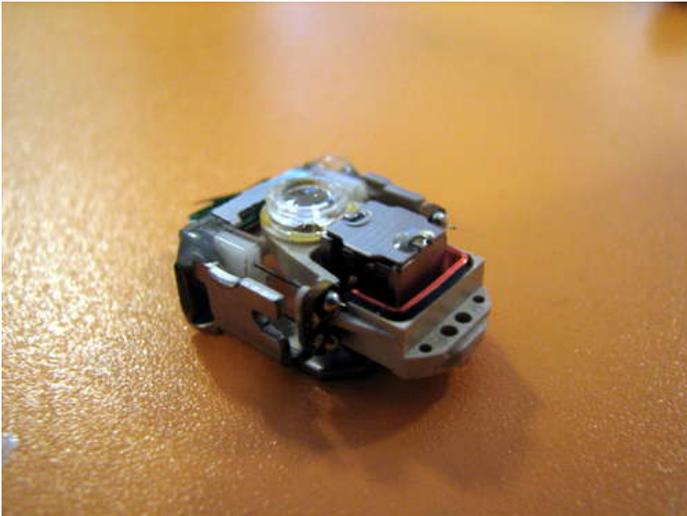
You'll have to unscrew a looot of screws to disassemble the CD drive. If you have no better idea, just remove all screws you can find and try separating the components. In the later stages it might sometimes be necessary to apply brute force, but usually it's possible to separate all of the surprisingly many parts of a drive without damaging them.

The picture shows what you're hunting for. It's the moving lens part of the optical head assembly.

It can look a bit different, depending on your drive. It has a static back and moving top part. Inside the moving part are two coils, one moves the lens up and down, the other one left and right. Permanent magnets are fixed to the static back.

If you're lucky, you will just be able to unscrew it. But sometimes you won't be able to separate it from the bigger optical head with the lasers and pickups inside. That's OK too.

See the wires in the last picture? That's what you'll add next!

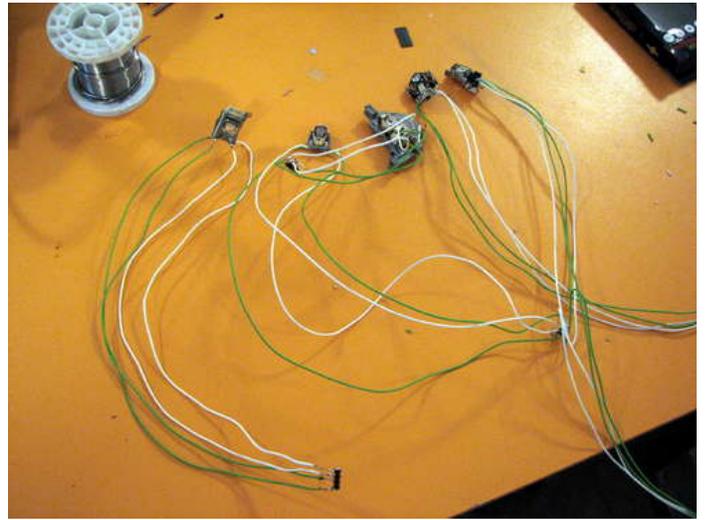
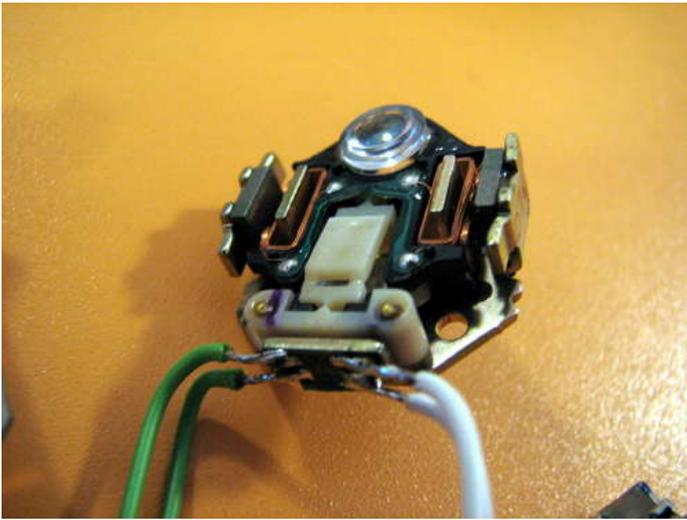


## Step 3: Solder wires to the lens head

Identify the contacts on the cd lens - there are four, a pair for each of the two axes. they are connected to the flexible wires holding the moving plastic part with the lens and the coils.

Strip the ends of four wires and solder them to the contacts... be patient, these are small points to solder to.

Strip a short length at the other end of the wires and coat them with solder to make them stiff and fit better with the Arduino.



#### **Step 4: Glue the stick to the mirror**

Put the mirror shiny side down on the desk. Hot-glue the short wire to the back surface of the mirror vertically.

The resulting piece has a T shape if the mirror side on top, as it will be in operation.



#### **Step 5: Mount the lens head to the housing**

Mount the lens head upright to a side wall of the box you're using, with a few millimeters clearance to the top ("ceiling") of the housing.

The lens itself, which used to be looking up in the cd drive, should be pointing horizontally from the wall towards the center of the box.



### Step 6: Mount the moving mirror

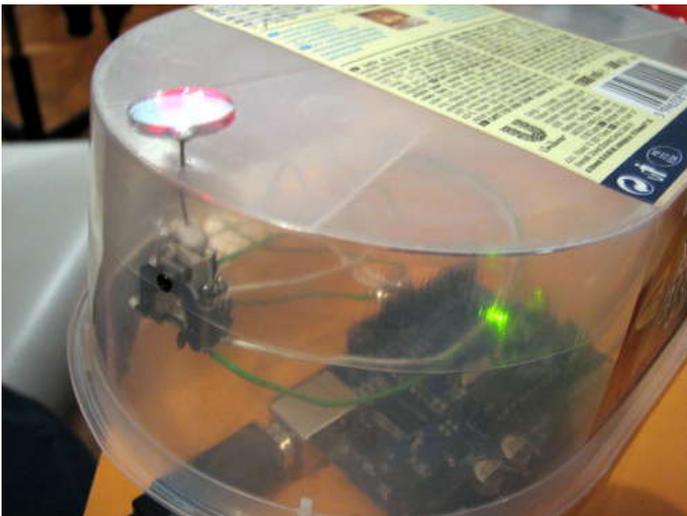
Poke a small hole in the housing right above the lens head.

Stick the wire holding the mirror into the hole until it touches the lens head.

Fix the wire to the head. we used a sticky putty-like glue made for putting posters on walls. A small ball 2mm across is enough. It can also be done with a small dab of hot glue or superglue.

Let it settle for a bit, then carefully move the head around a bit with your finger. The mirror should tilt but stay attached to the head.

If you made the hole too big, glue a layer of strong sticky tape over it, and poke the hole in that.



## Step 7: Connect the signal source

If you haven't yet, get your hands on an Arduino board. Download the Arduino software and run some examples to get comfortable with the process. Then program the Arduino board with the code below.

Stick the wires coming from the lens head into sockets 8,9,10 and 11 on the Arduino.

It is important to put the pair of wires connected to one coil into sockets 8 and 9 and the wires from other pair in sockets 10 and 11.

These are chosen because the pins 9,10 and 11 on the Arduino have PWM capability, used by the analogWrite command in the code.

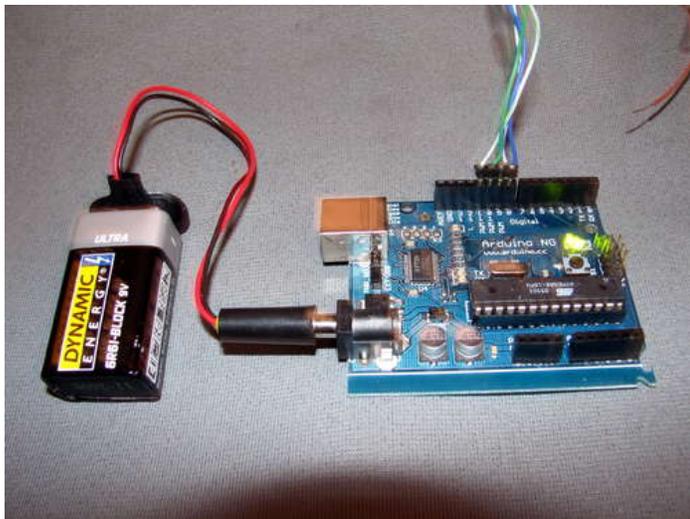
Apply power and hopefully your mirror will happily wiggle around!

For first test you don't need to fix the Arduino to the housing. You should have made the wires long enough for it to sit comfortably beside the box.

If you've used the Arduino, you can add a 9V battery like shown here to make your device portable. You can safely power it from your computer's USB power if you don't have a battery.

The Arduino source code follows:

```
/* LASER TAGS - CD LENS MICRO LASERSHOW (Copyleft) 2006 by linefeed @ Ljudmila.org GRL */ int t=0;int inc=4;int pause=1000;int x,y,x0,y0,x1,y1;int pt,
```



## Step 8: Shine some LASER light on the mirror

### WARNING: LASERS ARE NOT TOYS!

Make sure you do not point them at yourself or your friends. With reflections the path of the laser can be somewhat unpredictable. Always be careful, you can seriously damage your eyes even with low power lasers!

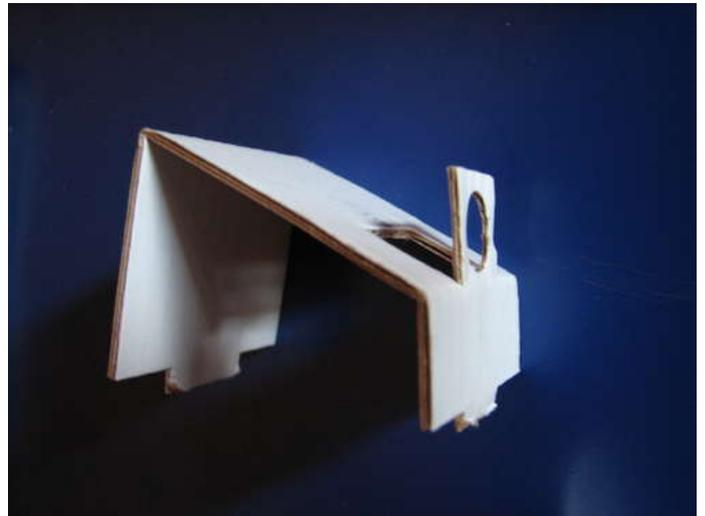
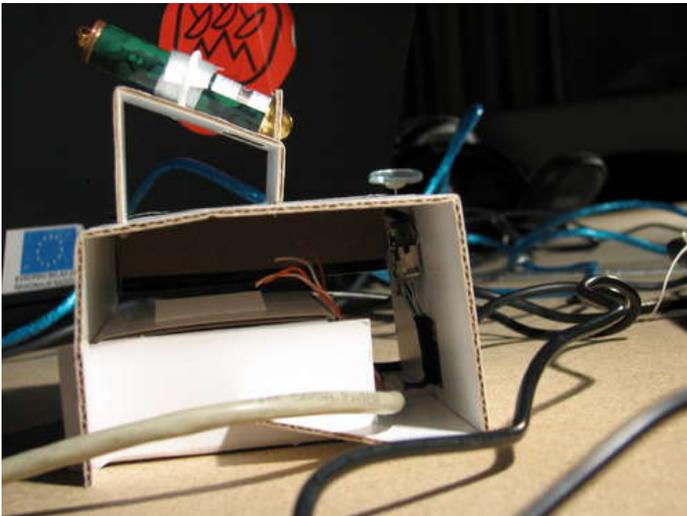
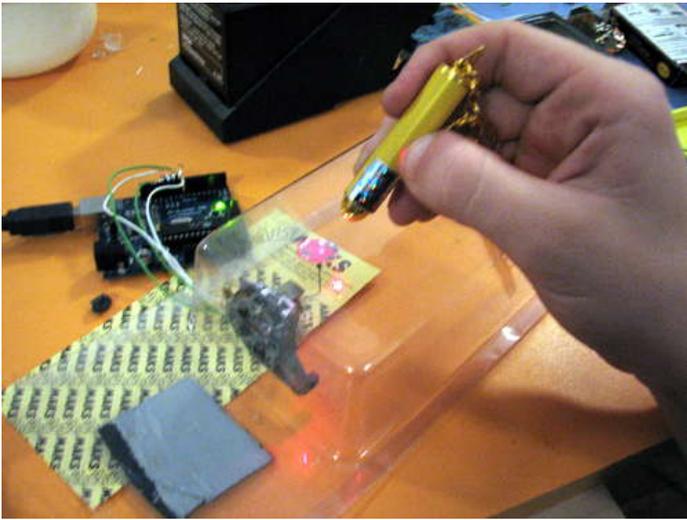
Keeping this in mind, take the laser pointer in your hand and shine it on the mirror, so it bounces off it and hits the wall. The spot will dance around as the mirror wiggles and you will see a persistence-of-vision image if it cycles fast enough.

Happy times - I hope - your projector works!

To finish up, mount the pointer permanently on an angle looking down, pointing at the mirror. Here you will need some ingenuity. The details of this will depend on what you're using for the housing and what else you got at hand. In the pictures you can see the part used in the original cardboard housing that Bjorn of Origatronica fame helped me make.

The button is most easily kept pressed with some kind of a clip. Probably you can use a clothes-peg.

Lasers work best, but if you don't have one, you can try to use the sun as a light source. Or a strong spotlight shining from reasonably far away.



### Step 9: Go out and tag something! (and report your results)

If you followed this instructable to the end: Congratulations! You just made a device with great potential for light graffiti.

Now find a nice big wall in town that just calls for esthetic improvement trough animated laser tags!

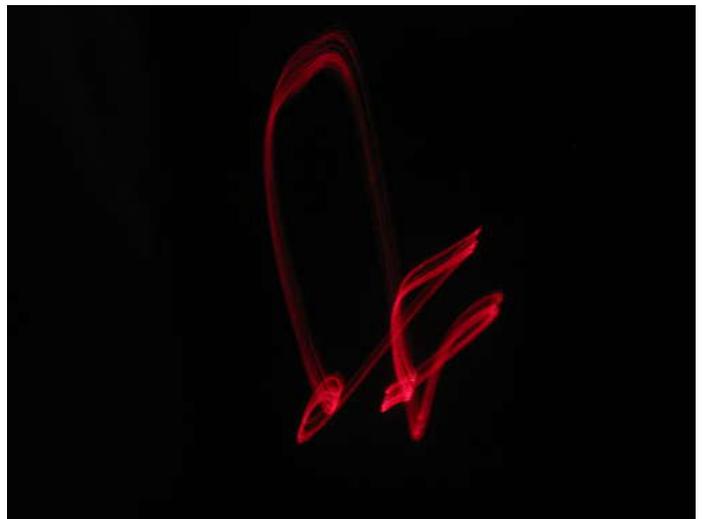
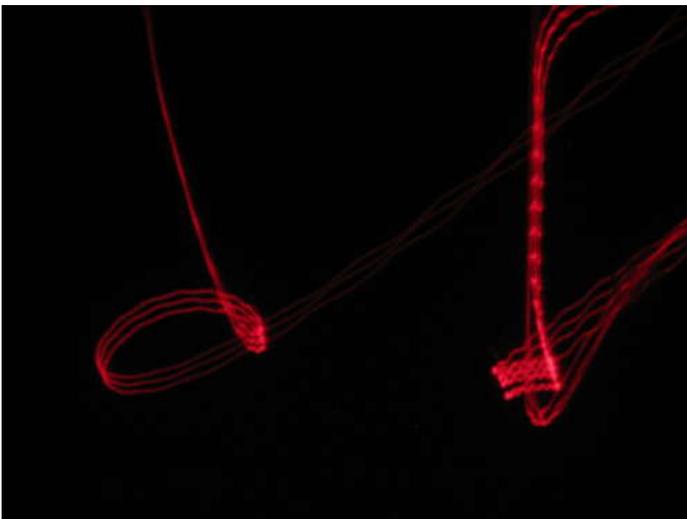
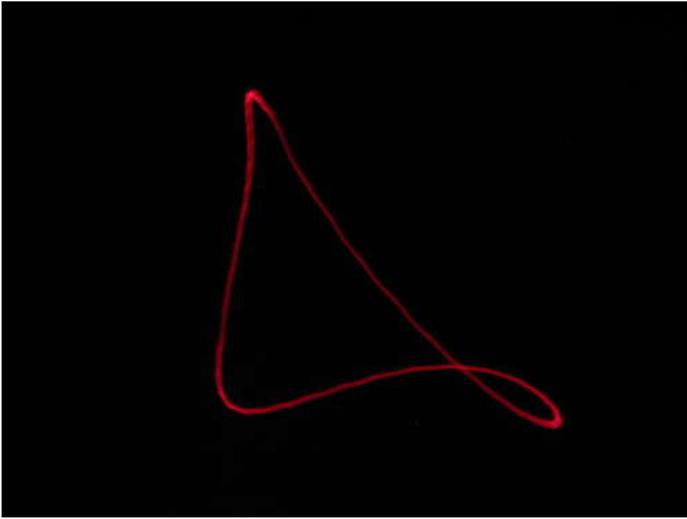
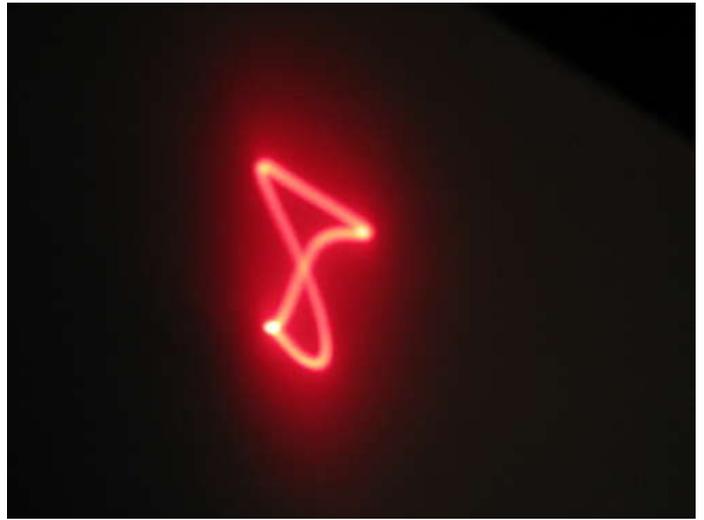
Take a camera with you and record the fleeting images with a long exposure timlight graffiti expressions.

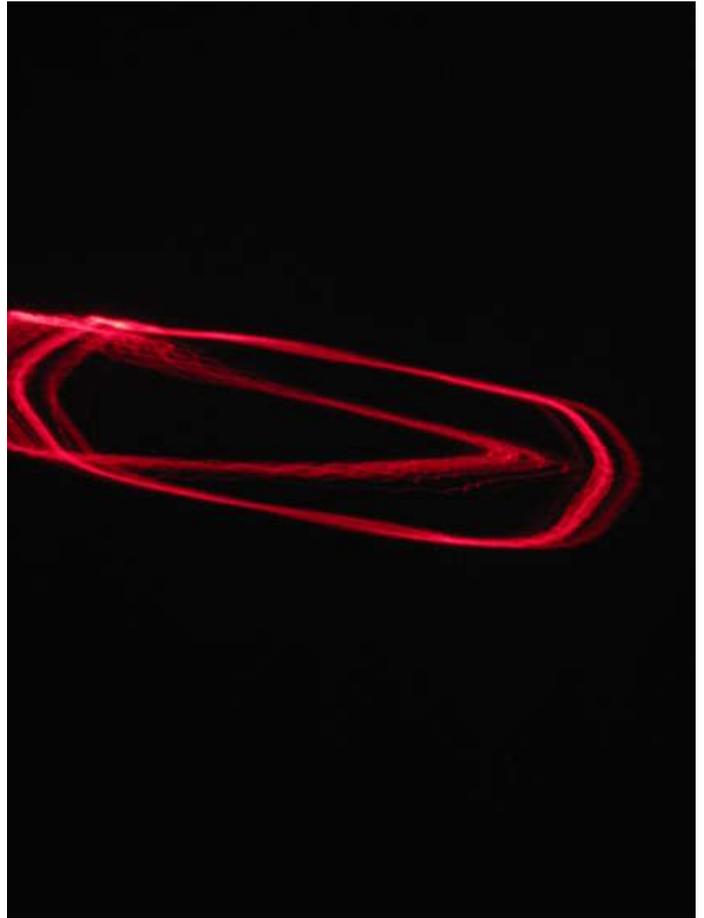
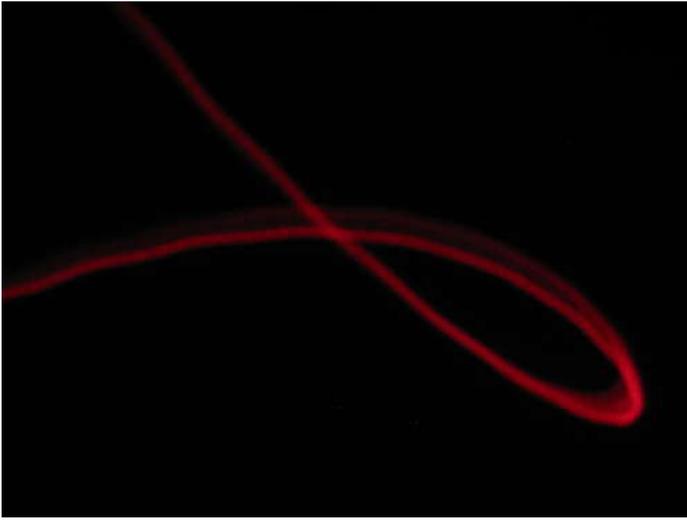
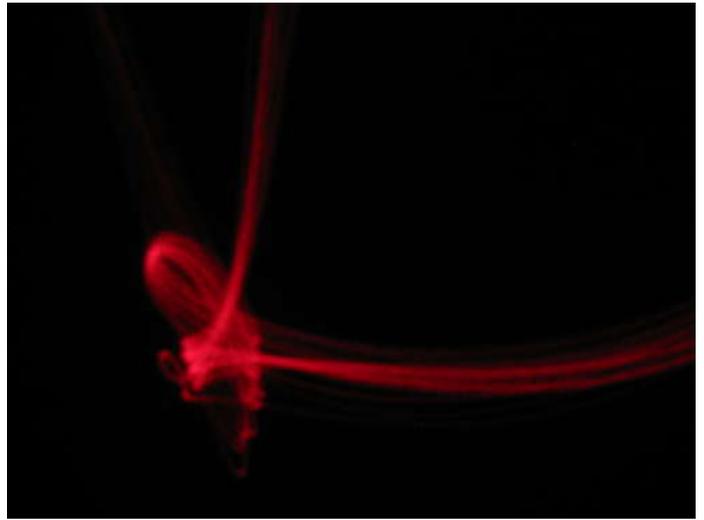
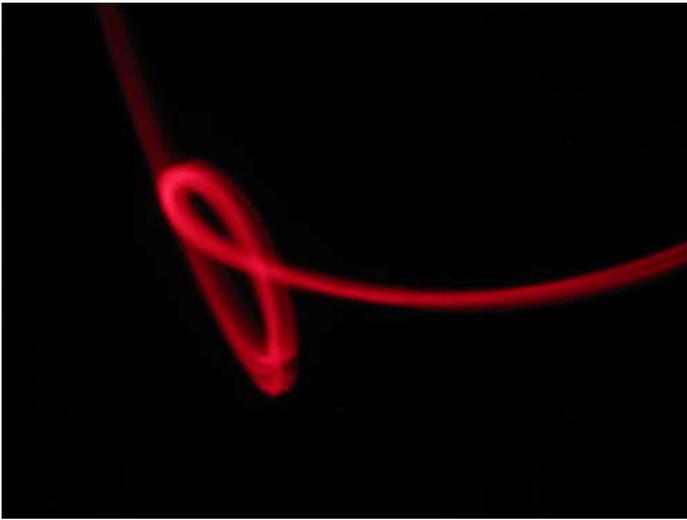
I hope i have described everything clear enough! Do let me know of your success or troubles while making and using these.

The Arduino code will give you a head-start. The patterns are written as series of coordinates to let you add new ones. Many improvements are still possible in the code. I suspect the quality of the picture and complexity of possible shapes can be much improved with somewhat smarter code driving the actuator.

You can experiment with other signal sources, stereo music players will probably be interesting.

Another idea for improvement you could try is to control the laser power with the Arduino too. This way you could program discontinuous patterns by turning the laser on and off at the right moments in the cycle.





**Related Instructables**



**The EyeWriter**  
by Q-Branch



**how to be a graffiti artist** by  
amtdude



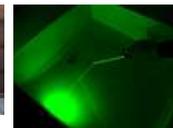
**How To Start Your Own Graffiti Research Lab**  
by fi5e



**Solar Powered Light-Graffiti Projector** by  
RDN1



**How to draw graffiti** by  
icecream\_n\_cake4



**The waterproof laser case!** by  
thecheatscalc

## Comments

31 comments [Add Comment](#)



**AndyGadget** says:

Dec 7, 2009. 3:33 PM [REPLY](#)

I had a similar idea, had a quick web Google for a laser display using a CDROM drive coil assembly and was directed straight back to good old Instructables.

I've extracted the coil assembly and wired it up and can see it moves side to side and up and down under the influence of the coils. It's also centre biased, so to get full range of movement you need to pass current through the coils both ways.

I can see you've used the pivoted rod at right angles to translate this into X and Y motion, but the mass of this will limit the speed. Have you tried other ways of doing this? (My initial idea is a mirror attached at a corner using flexible silicone rubber close to the assembly, then a small rod straight up in the plane of the lens, which will rock the mirror (X axis) or tilt it (Y axis) as the lens moves.) This would be more compact than the rod design, but a lot more fiddly to make. I'll report back (and probably post an Instructable) if I make progress with it.



**gd\_illeperuma** says:

Oct 28, 2009. 11:37 PM [REPLY](#)

Hi,

I was just wondering .. Isn't the lasers bad if its hit your eye ?

Any safety suggestions. (I've seen a video where a DVD burner laser burn through a balloon. I'd probably stay with the CD )



**chimere** says:

Jun 8, 2009. 6:26 PM [REPLY](#)

I'm curious, just how fast do these CD lens assemblies move? Can they move with high enough frequency to project POV images, or did you need to use a long exposure to capture your images?



**linefeed** says:

Jun 8, 2009. 8:26 PM [REPLY](#)

i have not measured their resonant frequency (anybody have an estimate?) but they are fast enough to project simple shapes at pov speeds.

i used one recently with nice results on dark facades of [metelkova](#) and on the wall behind a dj at our local spring welcome festivities . it was packed with 8 nimh aa batteries and powering the laser pointer with the arduino's 5V. it lasted all night.



**hubi** says:

Jul 28, 2008. 8:40 AM [REPLY](#)

If you use an old DVD Burner, one of the Diodes is red (~650nm) one is IR.

from an 8x Burner u can get 90mW from a 16x Burner u can get more than 200mW if properly cooled. Here [http://dreiling-kamen.net/hubidrei/html/dvd\\_laserdiode.html](http://dreiling-kamen.net/hubidrei/html/dvd_laserdiode.html)

is how I made it.

I found a [german Site](#) , where the same is done much easier without microcontroller and the mirror also comes from the Drive.

Sorry for my bad english



**thermoelectric** says:

Jul 29, 2008. 2:01 AM [REPLY](#)

It would be alright if i could read it Time to start learning german :[



**rocketman221** says:

Dec 27, 2008. 3:09 PM [REPLY](#)

here is the translated version



**thermoelectric** says:

Dec 27, 2008. 3:21 PM [REPLY](#)

Oh, Thanks It wasn't as interesting as I thought it would be...



**hubi** says:

Jul 29, 2008. 5:09 AM [REPLY](#)

maybe you will try google translation or if you use firefox, there are lots of translation addons available, like quick translation, translation panel ...



**LukeKuke7** says:

Jul 28, 2008. 7:04 PM [REPLY](#)

Sorry for my bad english?

Your english is better than some of the people on this site who's **first language** is english.

No need to apologise, and thanks for the link.



**linefeed** says:

Jul 28, 2008. 10:24 AM [REPLY](#)

Thanks for the link hubi, was not aware of that site. This is indeed very similar, with a somewhat different way to mount the mirror. I'll add a note about using the mirror salvaged from inside the optical assembly.

I agree that using a DVD laser diode turned into a pointer for this would be the coolest. But that's a more difficult project in its own, and also well documented on Instructables already.



**alex-sharetskiy** says:

Jul 27, 2008. 10:50 PM [REPLY](#)

Now if only you could use the laser inside the CD lens to do the show... Great instructable by the way!



**Kiteman** says:

Jul 28, 2008. 4:33 AM [REPLY](#)

Some drives (DVD? I forget) have UV lasers instead of visible light. Actually, I would like to see the whole thing mounted inside a box (laser-pointer and all), with a window (or hole) for the laser to shine out of, then you could leave it unobtrusively on a wall. Excellent project all the same.



**lan01** says:

Aug 10, 2008. 8:44 PM [REPLY](#)

CD drives use IR, DVD drives use red, and Blu-Ray drives use **blue**. They are very much too powerful for this though, unless you want to etch your wall.



**rocketman221** says:

Dec 27, 2008. 3:06 PM [REPLY](#)

bluray drives use 405nm violet lasers and it would only etch the wall if you took it from a burner.



**alex-sharetskiy** says:

Jul 28, 2008. 7:57 AM [REPLY](#)

DVD drive or burner? Regular ol' CD players have an infra-red laser, i checked this by popping a CD into a CD player, taking the cover off, and using night vision on a camcorder.



**Kiteman** says:

Jul 28, 2008. 8:57 AM [REPLY](#)

IR or UV, either way, neither are any use for a light show.



**alex-sharetskiy** says:

Jul 28, 2008. 9:14 PM [REPLY](#)

if yo u have a cellphone camera, or reglar camera, you can see it



**Kiteman** says:

Jul 29, 2008. 2:53 AM [REPLY](#)

Yeh, but when you're trying to make a *show*, it's not much good if people can only watch it via a video.



**alex-sharetskiy** says:

Jul 29, 2008. 8:20 AM [REPLY](#)

god point



**kyotee** says:

Oct 15, 2008. 3:06 AM [REPLY](#)

Im having a go at doing this myself but using only audio signals to drive it, so far no results as i need software that can generate digital signals through audio and with individual left and right "speaker" control. System of a down makes large scribbles!



**linefeed** says:

Oct 15, 2008. 7:25 AM [REPLY](#)

wow first builder! great to read this kyotee. please definitely post some pictures!

you could try using [audacity](#) to make some 2 channel custom waveform sound... it's easy to use! [read manual](#)

and for real-time control something like [pure data](#) ? it's great fun playing with it, just don't be intimidated by its looks. [read manual](#)

i see you needed an amplifier, how did you hook that up?



**kyotee** says:

Oct 15, 2008. 4:54 PM [REPLY](#)

Im using a TDA7386 car radio amplifier that i got out of my busted headunit where i also salvaged the lens mechanism. Its not attached yet and im kinda busy for next few days but should be up and working within a week or so, i will definitely keep you updated with the results once i have some



**kyotee** says:

Oct 15, 2008. 5:07 PM [REPLY](#)

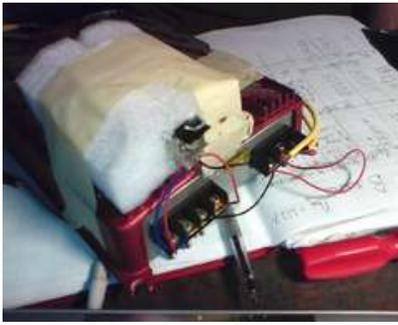
Just downloaded [audacity](#). it is exactly what i needed. Thanks a bunch. results to follow



**kyotee** says:

Oct 16, 2008. 4:07 AM [REPLY](#)

Have got lens mechanism moving in the x and so far theoretical y direction, it seems that when the mirror pivots in the y dimension it is somehow twisted back to the x axis. i think i need 2 lens mechanisms, one for x and one for y and i think this will be much better and with the setup im using it will not be hard to make this happen. i was too impatient to get my TDA7386 amp wired up so im using a sony xplod 222W lol a bit overkill but it does the job. (while i was waiting for picture to upload amp decided it was way too overkill(probably due to being a 4ohm rated amp and the coils on the mechanism wont be 4ohms i think)and has shutdown into protect mode!)



**ravebot** says:  
cool

Sep 17, 2008. 6:31 PM [REPLY](#)



**viacin** says:

wow... dude...wayyy to expensive for the board. I mean, if this was a robot..sure, but for this..c'mon. you can get the same result by gluing the mirror on top of a speaker.

Sep 17, 2008. 5:33 PM [REPLY](#)



**mycroftxxx** says:

I am a little confused by this instructable. Will it allow you to project an arbitrary vector image?

Jul 30, 2008. 1:30 PM [REPLY](#)



**linefeed** says:

In principle, yes, it's a 2D vector display. so far there is a low ceiling to the complexity of the shape. with the current arduino code the shapes are coded as arrays of integers. they are displayed in sequence on an endless loop. you do get great random variations and throbbing of the shape for free. :) the initial application we thought of was light graffiti. but it should be possible to create a basic oscilloscope, vector clock or even a game with some clever programming.

Aug 20, 2008. 3:36 PM [REPLY](#)



**Mr. E** says:

There is a service to translate web pages automagicaly  
try <http://ca.babelfish.yahoo.com/> it worked well on the German project page.

Aug 3, 2008. 7:16 PM [REPLY](#)



**vince\_nys** says:

Great tutorial, def. gonne try it

Jul 31, 2008. 4:28 AM [REPLY](#)