

# How to build a real lightsaber

December 11 2015, by Gianluca Sarri

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Credit: David James/Lucasfilm

As even casual Star Wars fans will know, lightsabers are probably the coolest weapon ever to make an appearance on the big screen. Lightsaber fights are so elegant that they are almost hypnotic and, even though not all of us might have a strong enough flow of Force running through our veins, a lightsaber in the right hand is by far the deadliest weapon to be found in the universe.

The idea behind a lightsaber is simple genius: a light-weight and immensely powerful tool that uses a blade of energy to not only slice up

disciples of the Dark Side in a single blow but also act as an effective shield against laser blasts. So why don't we have working lightsabers in real life? Surely physicists must be smart enough (and big enough Star Wars fans) to be able to produce one of these incredible objects.

The obvious way of building a lightsaber would be to use a laser, which can be seen as a particularly bright and directional burst of light. But even though [laser technology](#) is continuously striding towards more efficient and practical machines, we are still miles away from a working lightsaber. Let's see why.

The first challenge is making the blade of your lightsaber an acceptable size, let's say around three feet or so. To do this, you would have to make the laser beam come to a stop at a certain point. This won't be easy since light has a rather strong natural tendency to [keep travelling](#) if it doesn't encounter any obstacles.

One solution could be to place a small mirror at the tip of the blade. But can you imagine how embarrassing it would be to show up in the battlefield with a lightsaber surrounded by a whole supporting structure for a tiny mirror at its end? Apart from being really fragile, such a blade wouldn't be able to hurt anyone.

The second problem is that the blade will need a lot of power to be able to slice through materials. Welding lasers used in industry can do that but they typically require [several kilowatts of power](#). The power supply for these lasers is huge and would certainly not fit in the tiny hilt of a lightsaber. Plus you would need a considerable cooling mechanism if you didn't want the hilt to become incandescent and to melt your hand.

Besides these more practical points, the amazing effects of lightsaber fights would be unfeasible. Two laser-based lightsabers would never clash against each other. They would simply pass through one another

with no effect. What's more, a laser focuses light in one direction so sharply that you [can't see it](#) unless you look directly down its axis. This is the reason why lasers used in clubs need smoke or fog to be seen. The smoke particles act as tiny scatterers that spray the laser light and make the beams visible.

But all is not lost. No one ever said a lightsaber had to be based on laser technology. An alternative exists already in the form of plasma. Plasma is effectively gas so hot that its atoms are broken into their more fundamental components, namely electrons and nuclei. They can be generated by applying powerful electrical discharges to a gas (lightning is an example) and are able to sustain searing hot temperatures as high as millions of degrees Celsius.

Most interestingly, hot plasmas tend to emit different colours depending on the gas they are made of. For example, a neon light is nothing but a tube filled with neon gas in a plasma state. The green lightsabers of Jedi knights could be made of chlorine plasma, which emits predominantly green light, while the red lightsabers of the Sith villains could be made of helium, which mostly emits in the red-to-violet [region of the spectrum](#).

How might a plasma lightsaber work in practice? A small but powerful [power supply](#) hidden in the hilt could be attached to a long and tiny filament that carries the electrical discharge and puffs some gas around it. When you turn it on, the filament would become incandescent and the gas around it would turn into plasma, emitting its colour in every direction. The searing heat of the plasma would instantaneously melt any object it touches, cutting cleanly like a [blade](#).

You might still have an issue or two in making everything compact (where are you going to store the gas to be continuously puffed out of the filament?) and sturdy enough to resist a blow from another

lightsaber, but it's a good start. After all, the Galactic Empire wasn't built in a day.

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