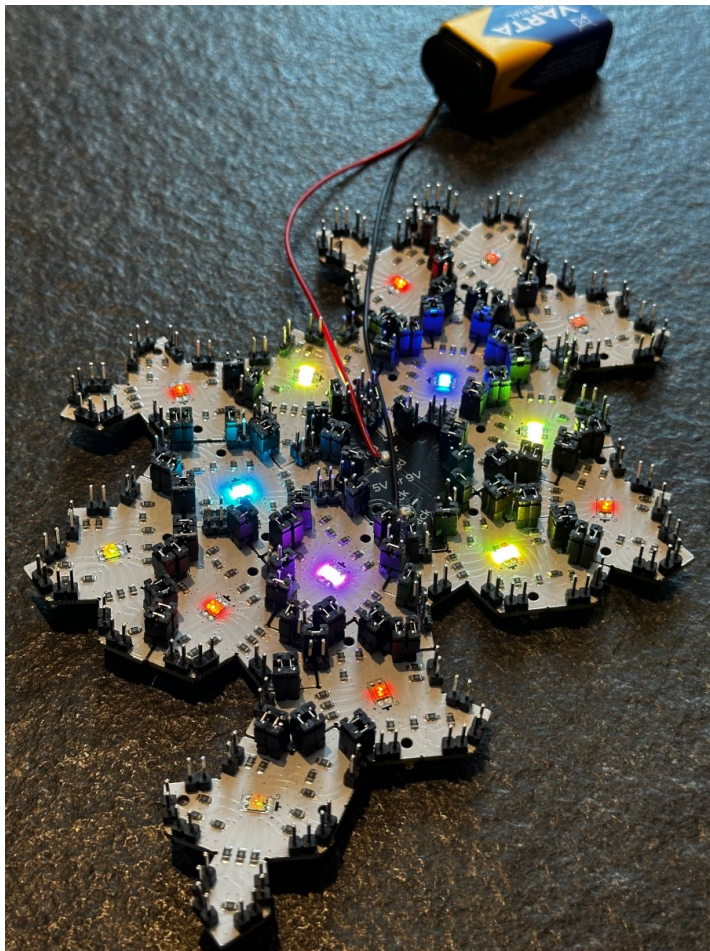


spectre

the aperiodic monotile soldering kit

where patterns never repeat,
and neither do the colors



where math
meets electronics
meets art



Kit contents, please verify you have all items

- 7 white spectre boards
- 1 black spectre be power board
- 9V battery connector
- a bag of 112+ 01x02 pins
- a bag of 100+ jumpers
- a QR code to the project homepage

tools required, not in the kit:

- soldering iron
- solder wire
- nail file or sand paper
- breathing mask
- 9V battery

spectre

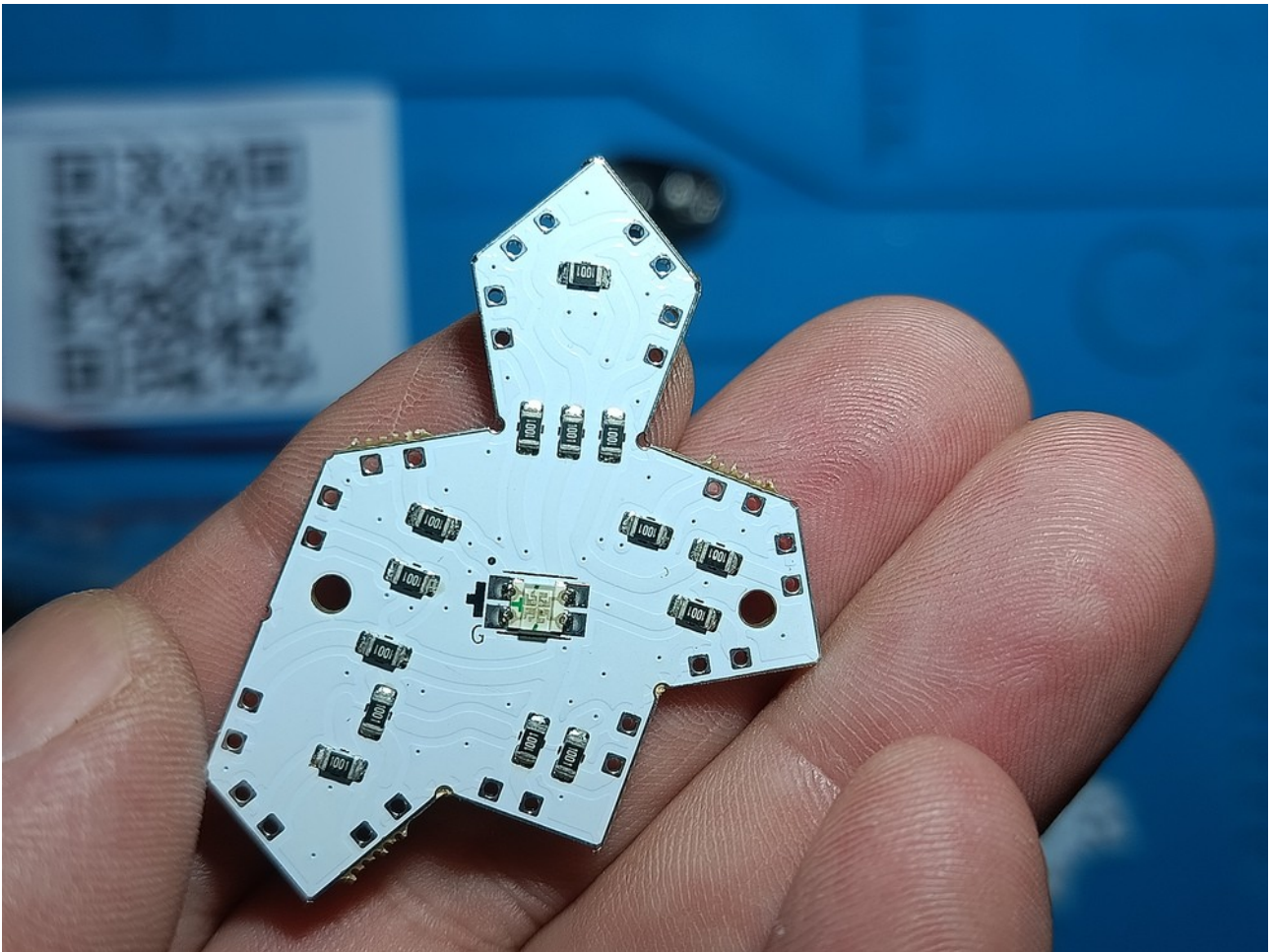
neither the name nor the shape is our invention. the shape was found only in 2023 by math researchers as the first single shape known that can seamlessly cover a floor without any gaps, and can never repeat, i.e. is aperiodic.

it's like the much wider (or longer) known penrose tiling that uses two shapes to create an aperiodic tiling, but with a single tile and 50 years younger.

a very similar shape was found in late 2022 by the recreational mathematician David Smith, his tile was named the "hat". a certain percentage of hat tiles had to be flipped front to back to create an aperiodic tiling. then in 2023 he worked with Craig Kaplan, Joseph Samuel Myers and Chaim Goodman-Strauss to find the "spectre", a single monotile that can tile a floor without gaps or flipping.

their paper can be found here: <https://cs.uwaterloo.ca/~csk/spectre/>





this is the front side of the spectre tile with the RGB LED in the center and resistors. all these SMD components are already populated. no need to solder there.



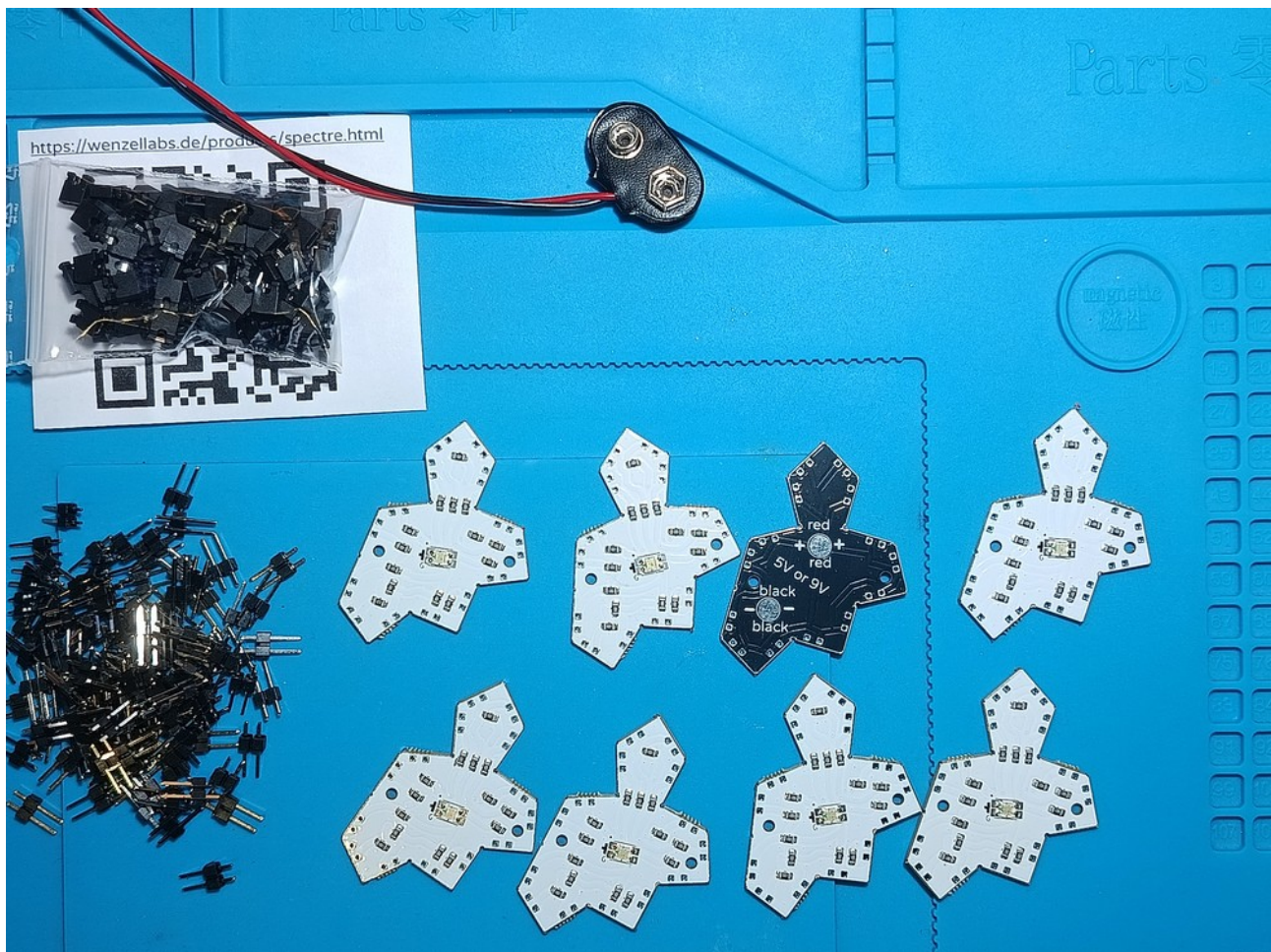
this is the back side of the spectre aperiodic monotile with a very brief instruction



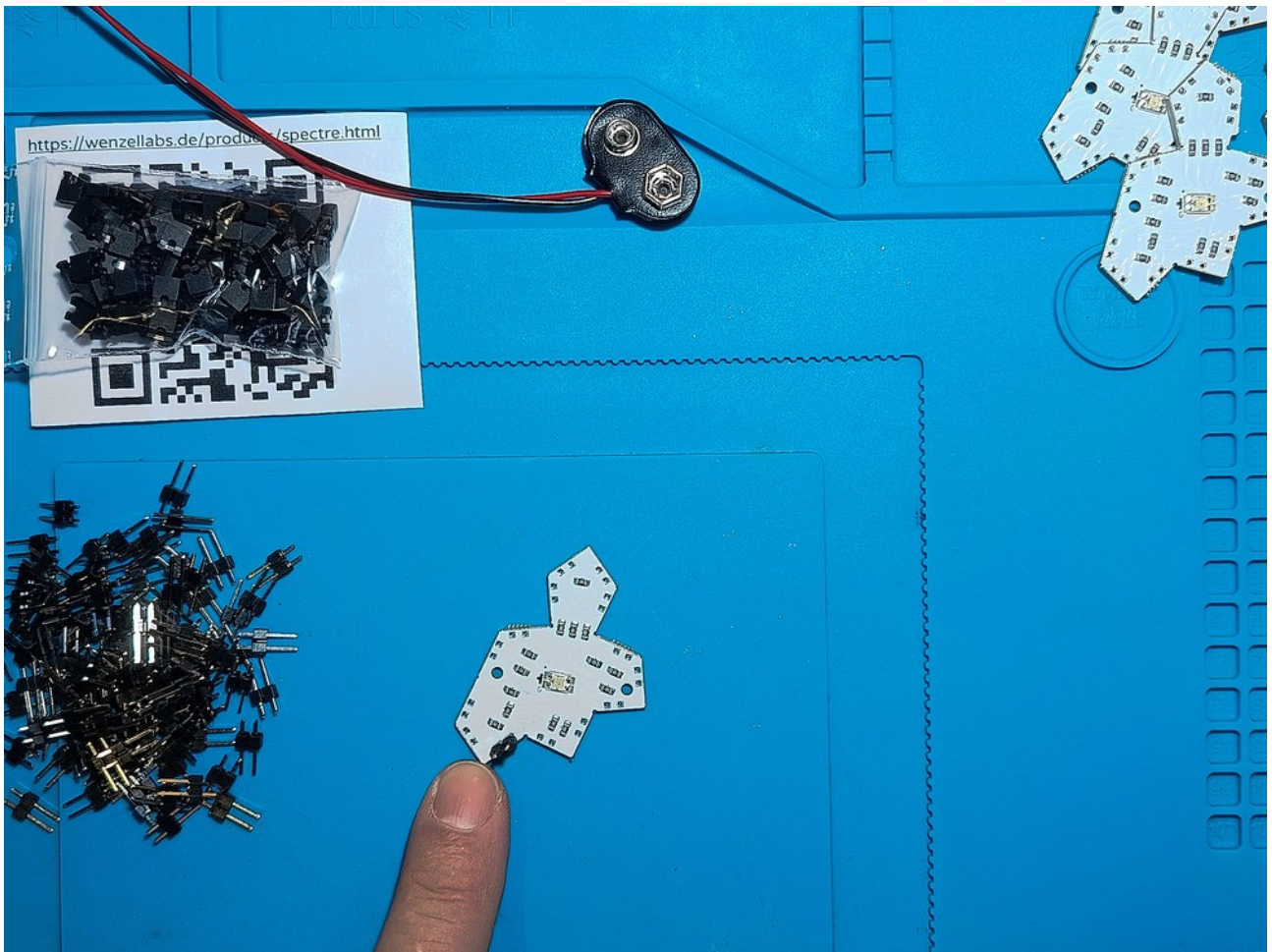
this is the front of the black spectre be power tile which has no LEDs or other components. it's only used to inject power into the puzzle



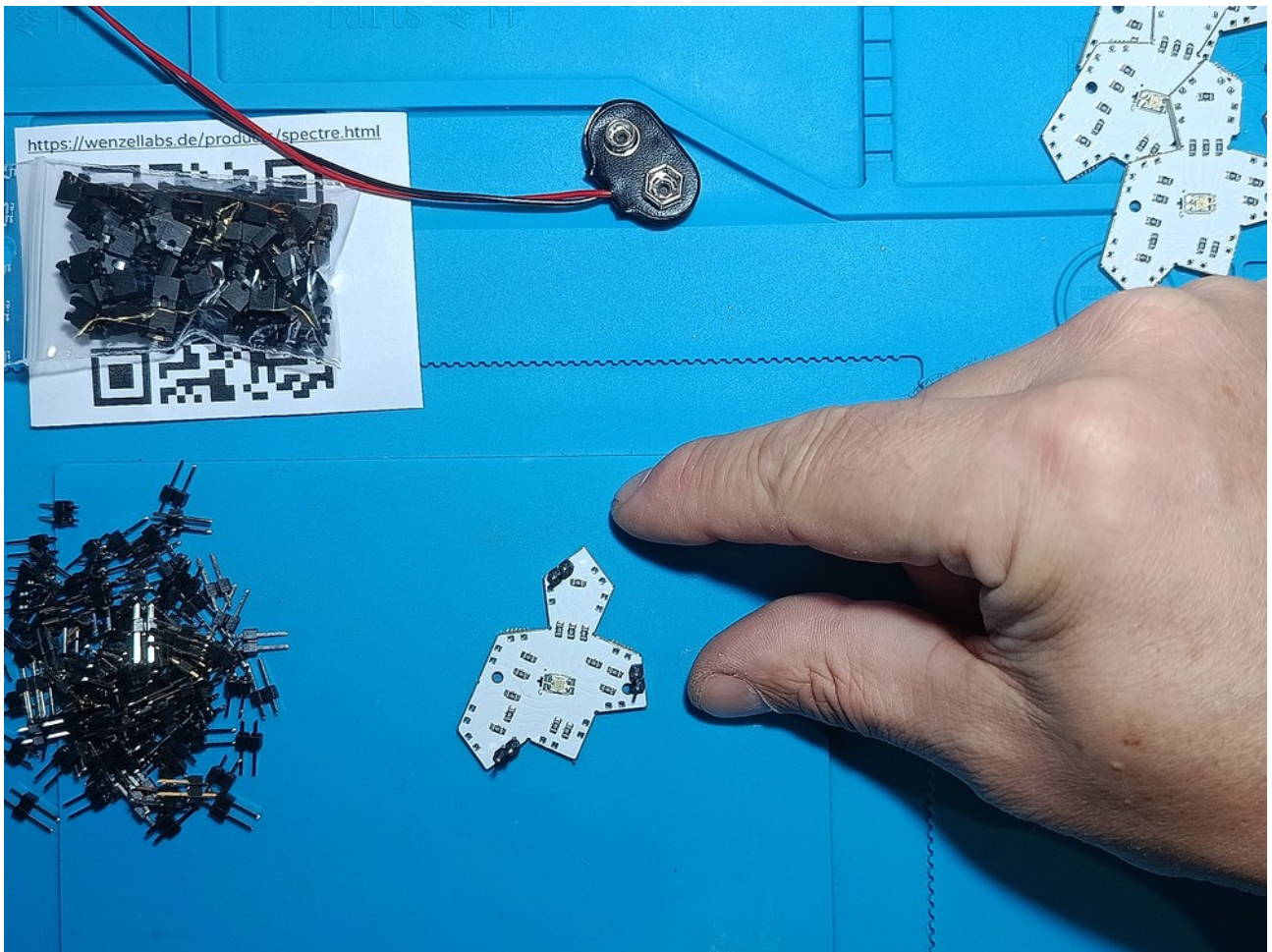
this is the back side of the black spectre be power tile



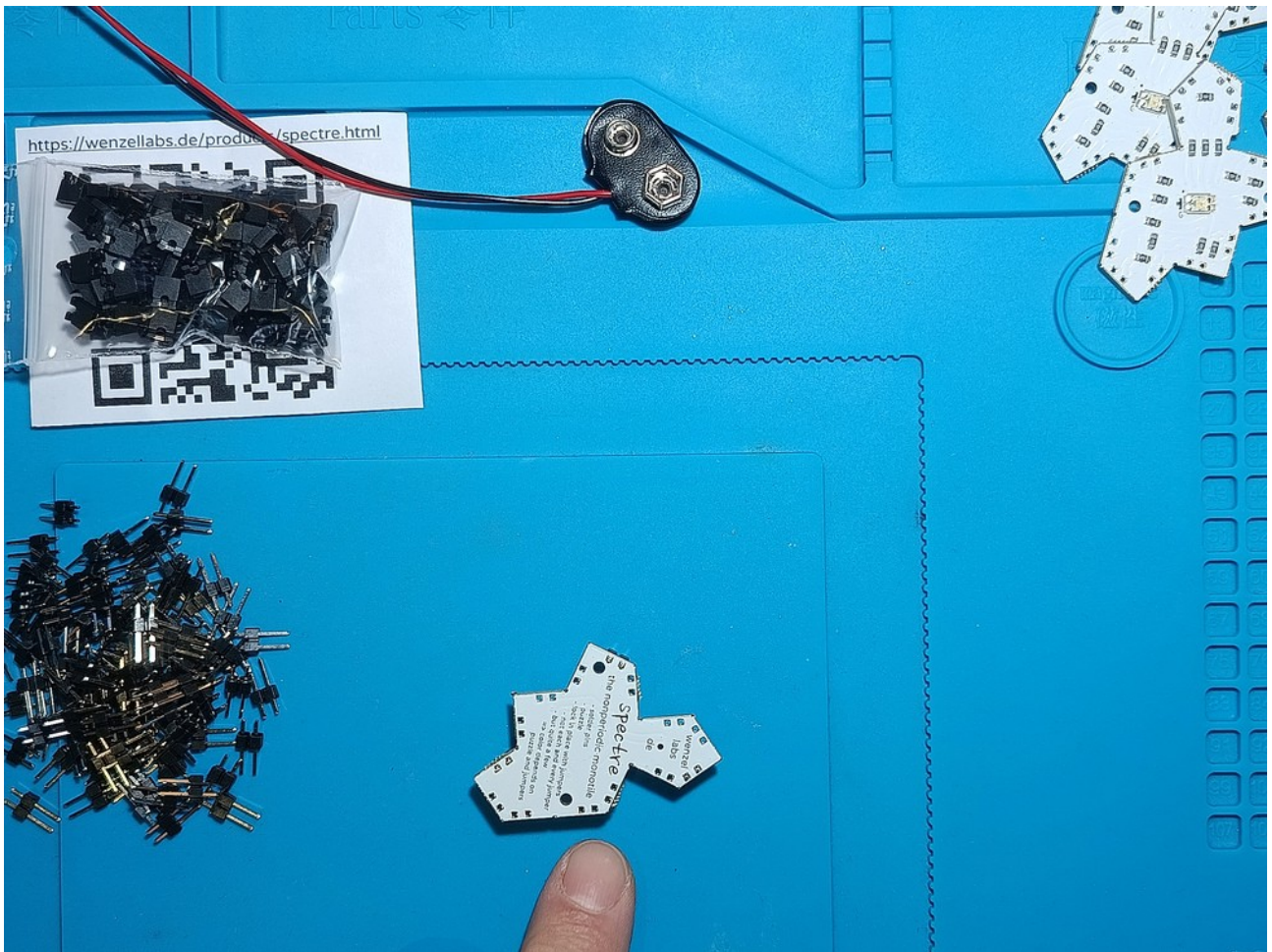
we start soldering with the pin headers



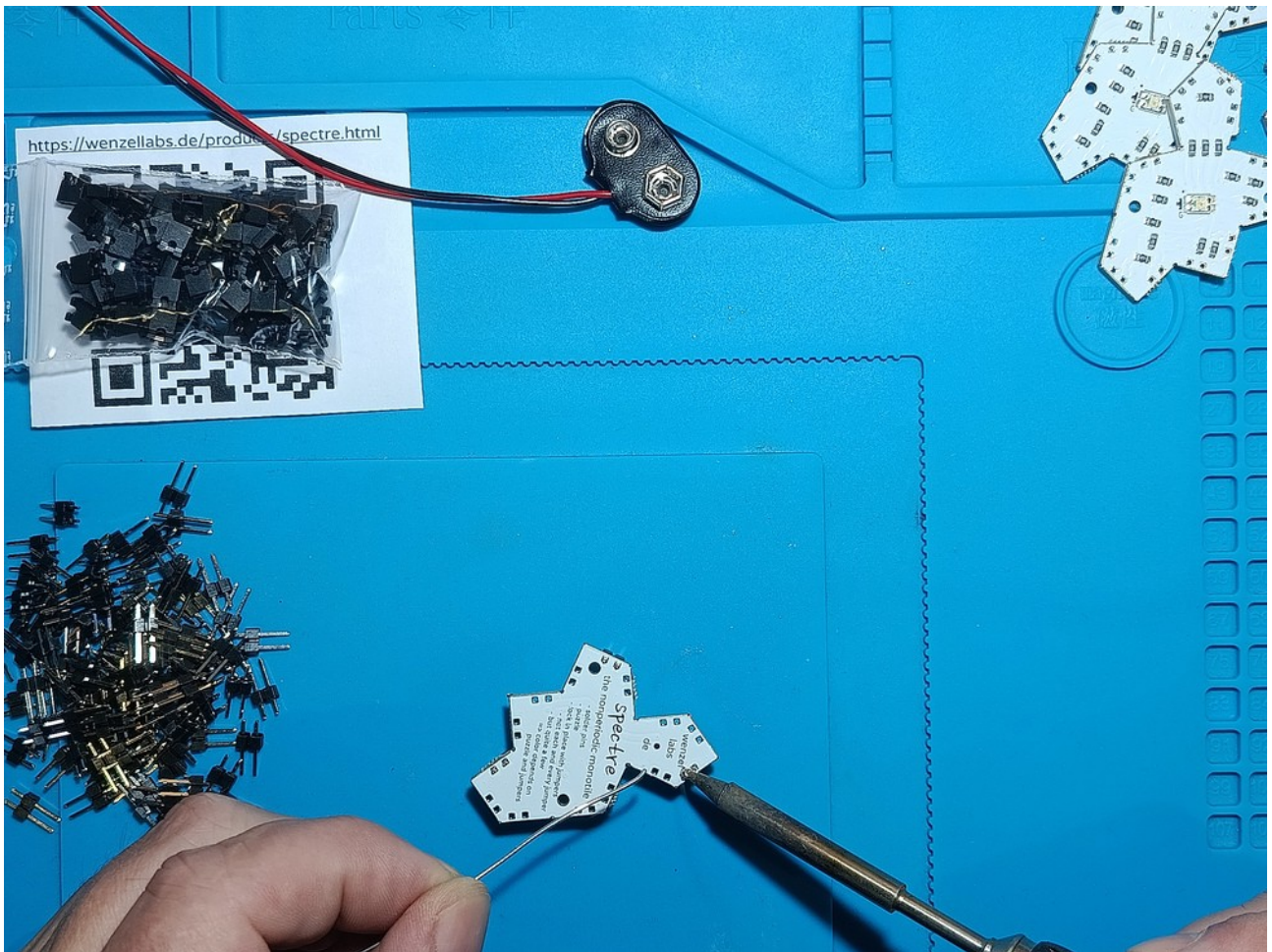
the pin headers go on the same side as the LED (and the resistors).



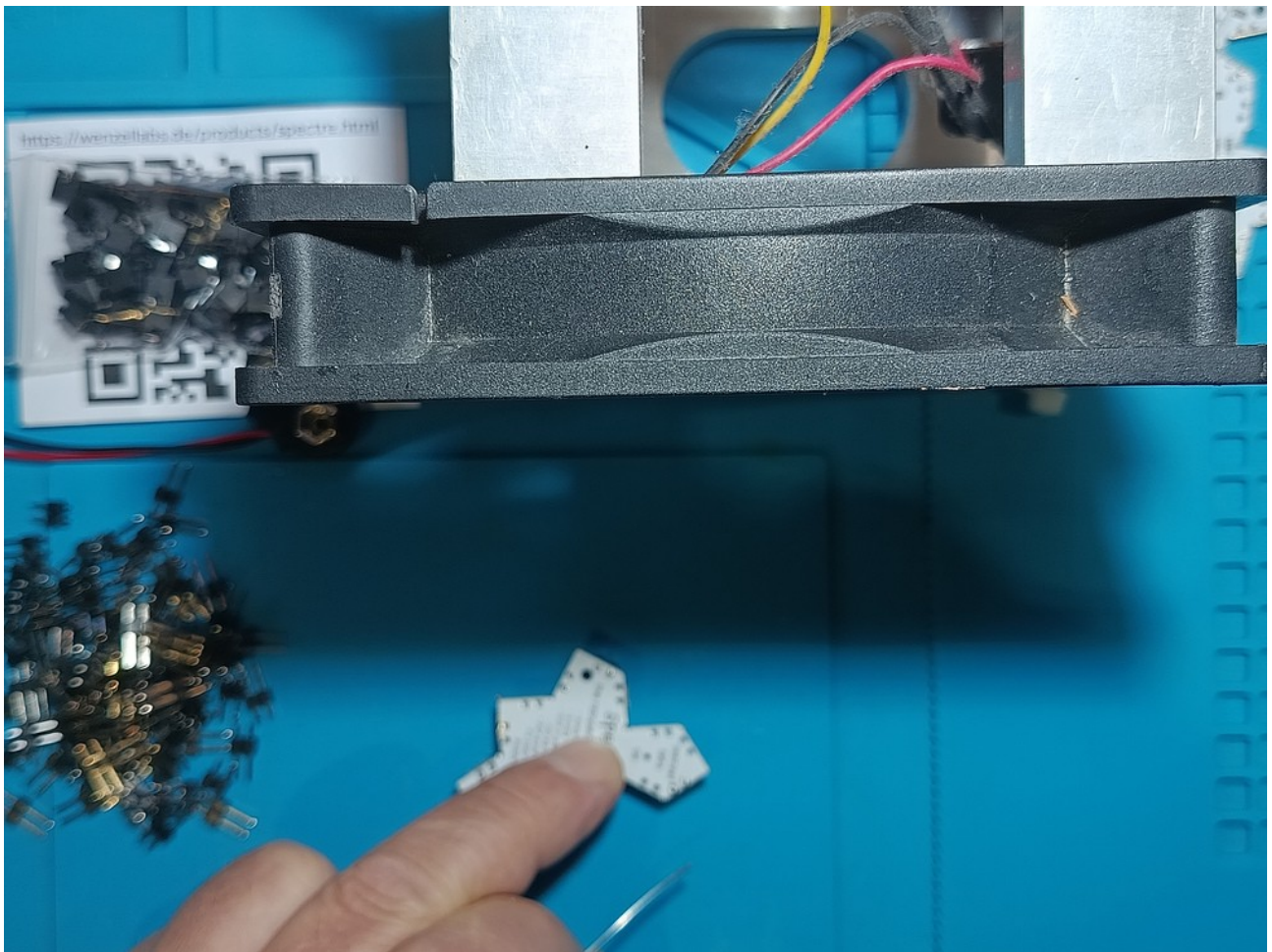
insert maybe 3 or 4 pins so you can flip the board over for soldering.



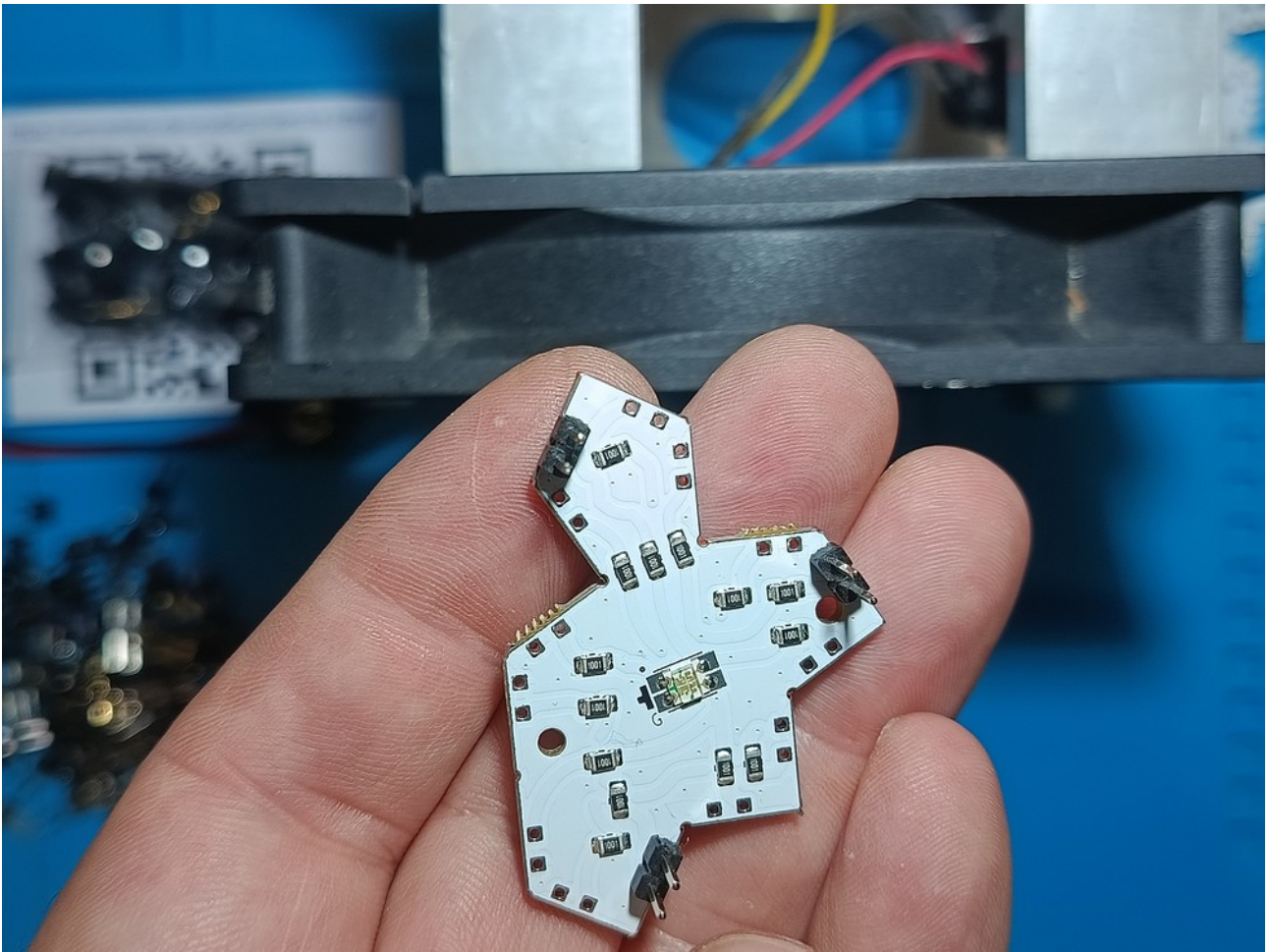
like so.



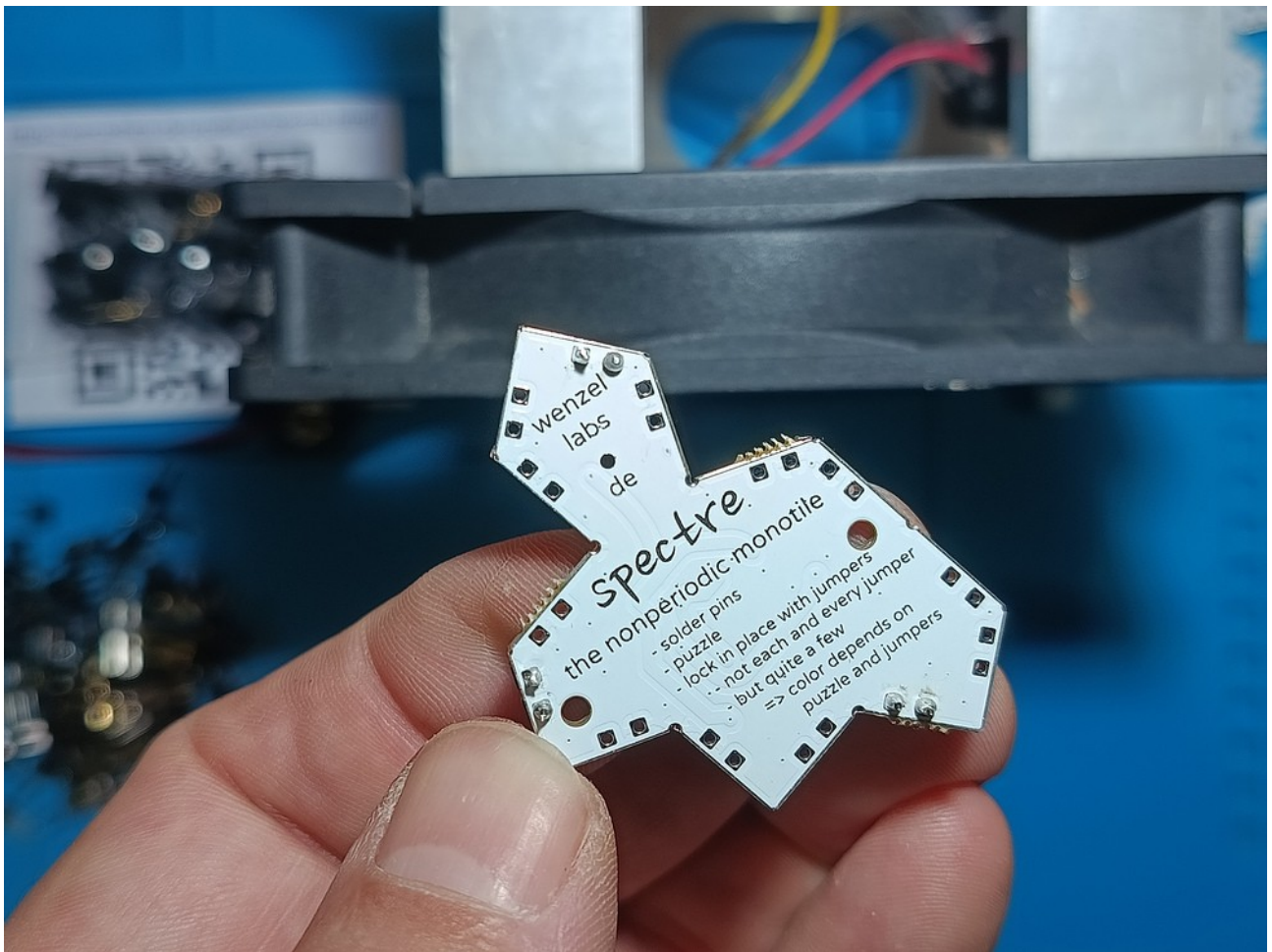
solder all the pins.



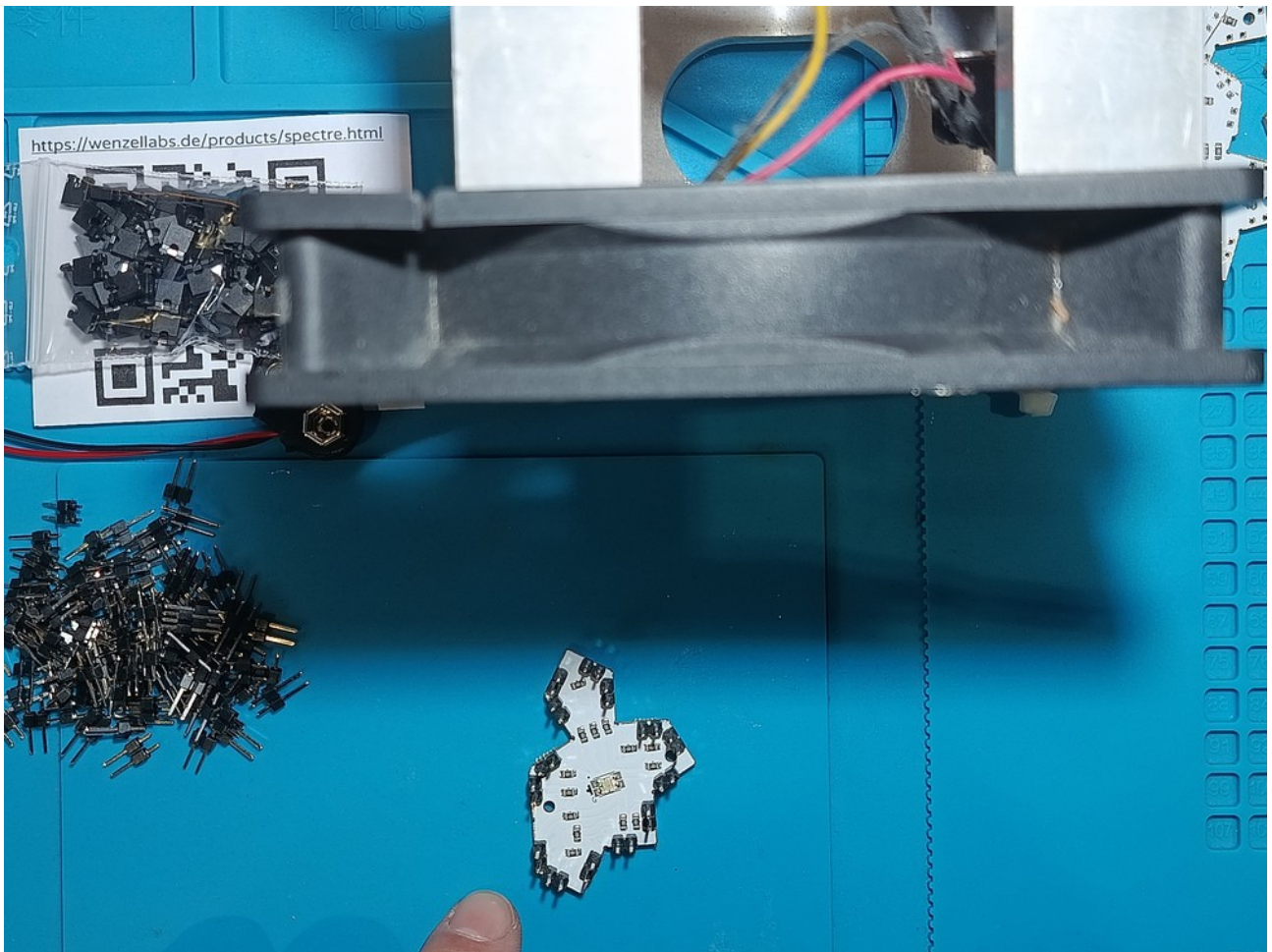
use a fan while soldering if you prefer.



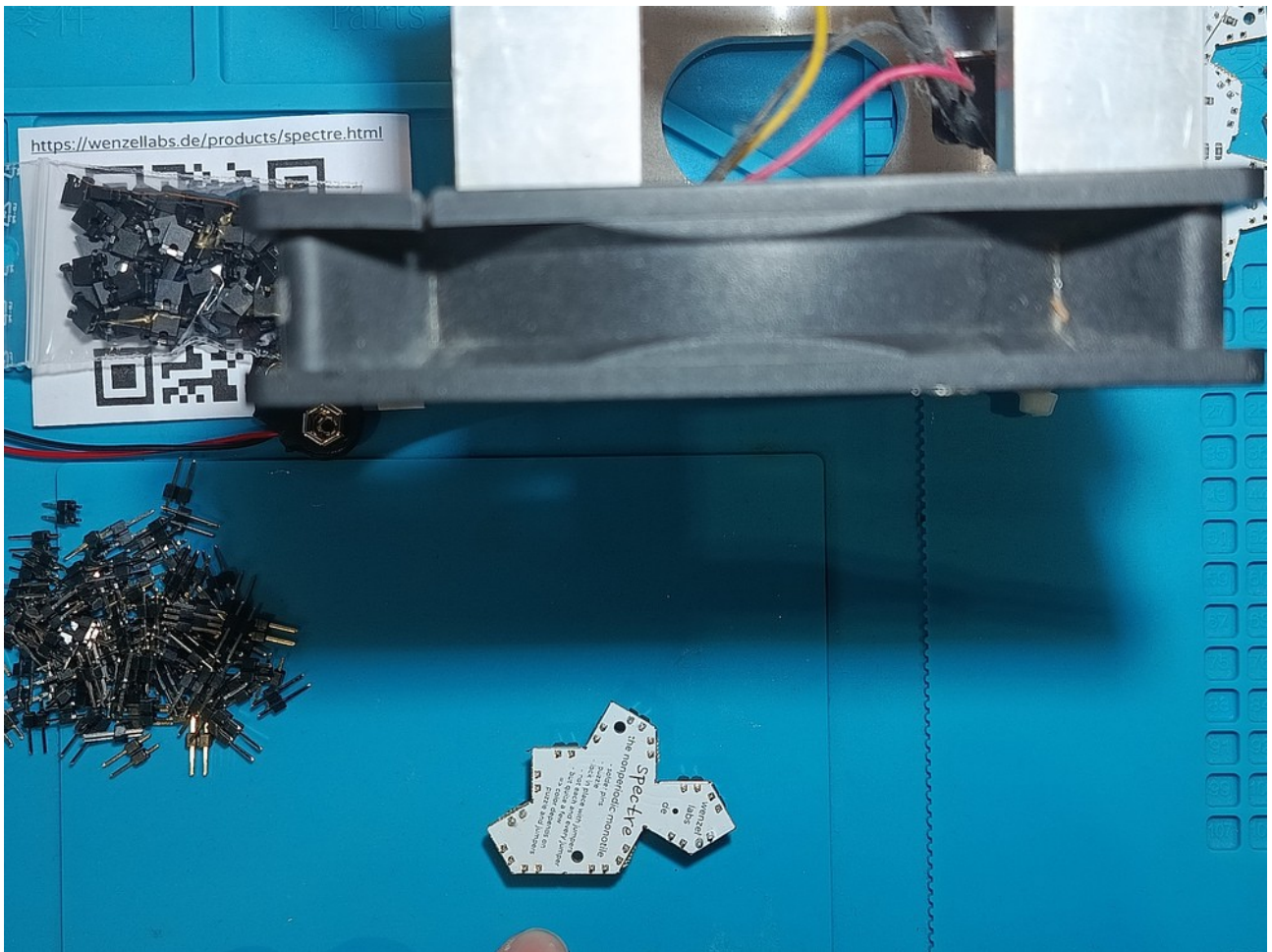
three pins down, 109 to go.



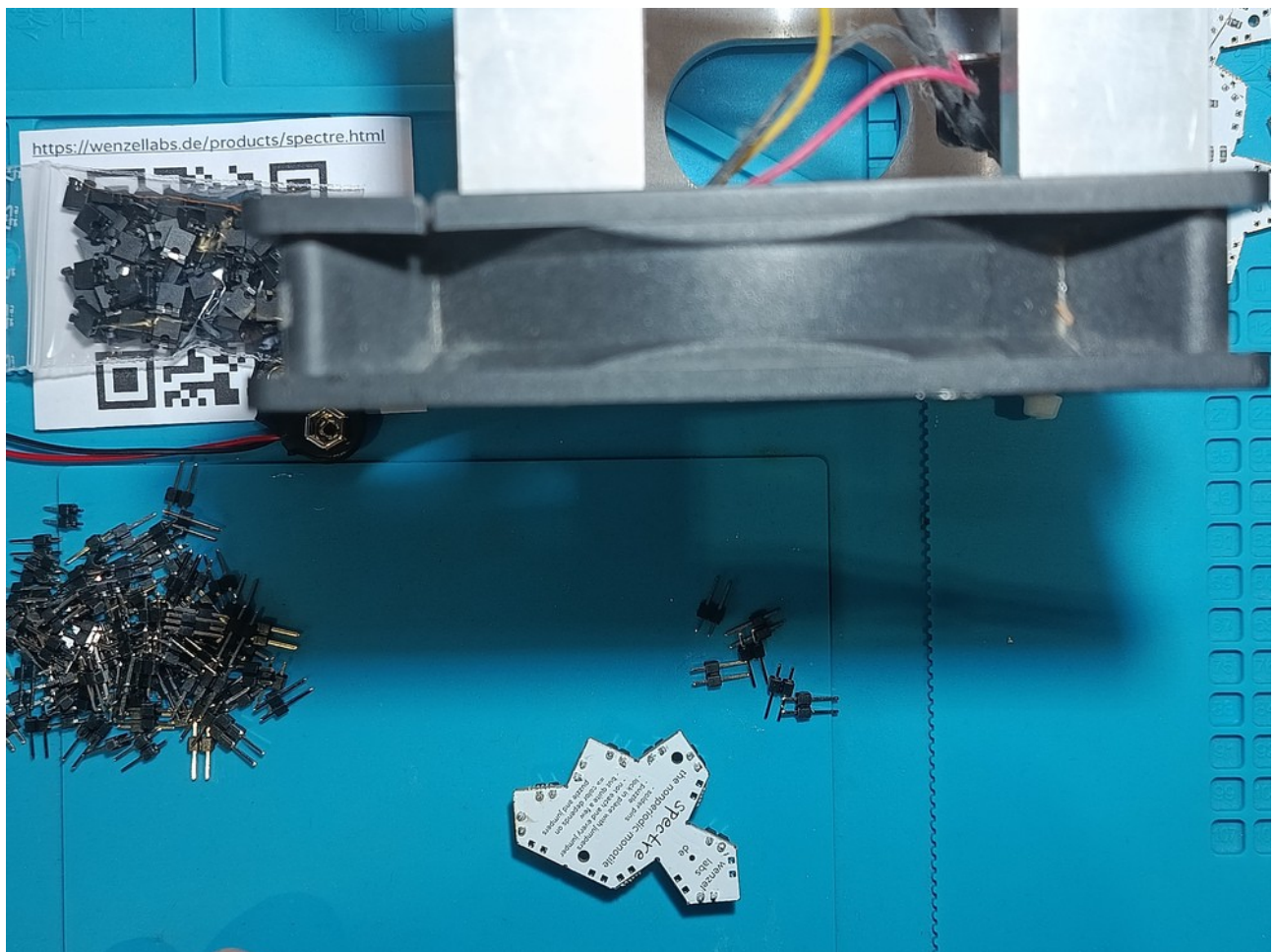
first pins soldered from the backside.



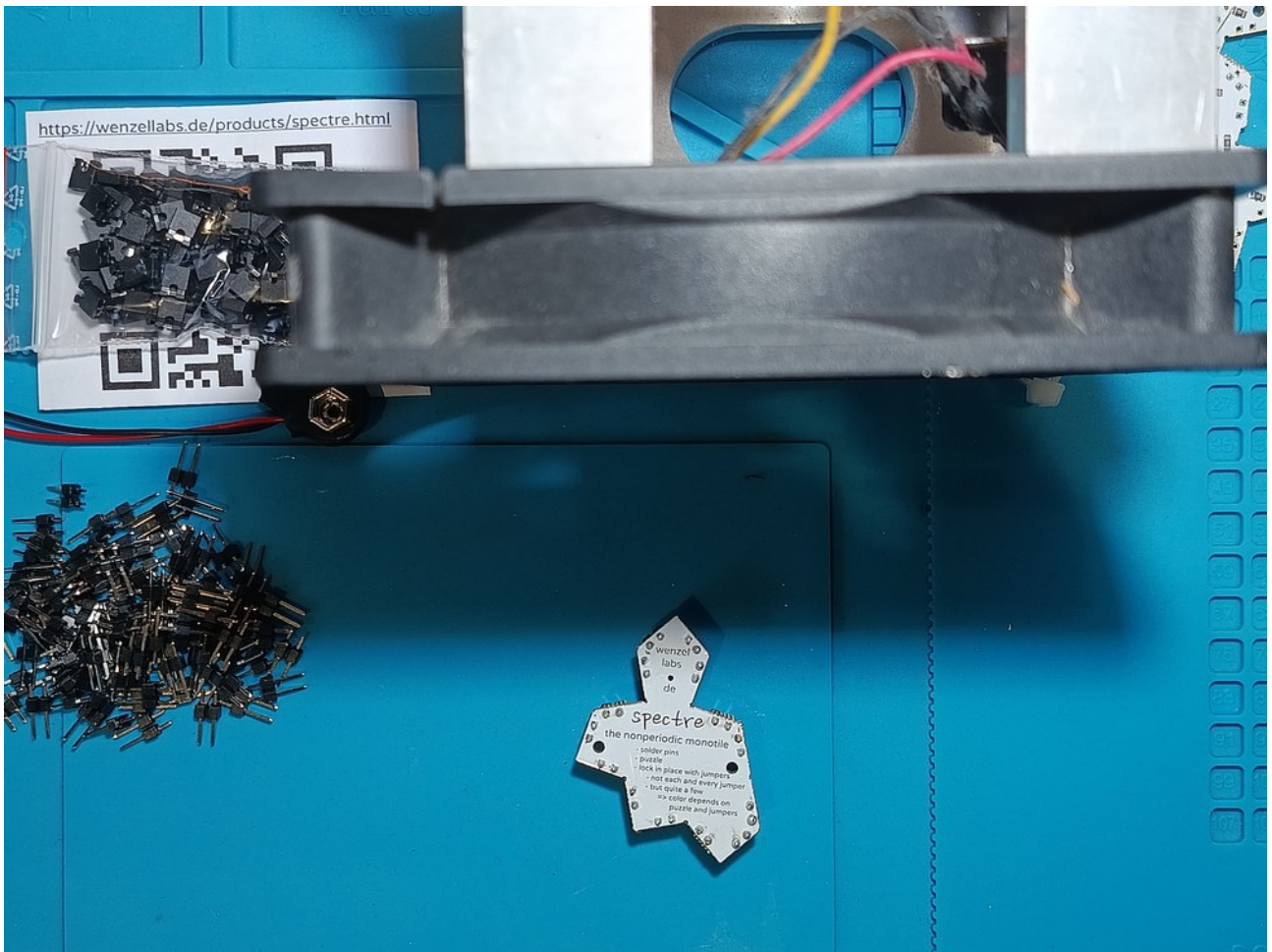
insert the rest of the pins.



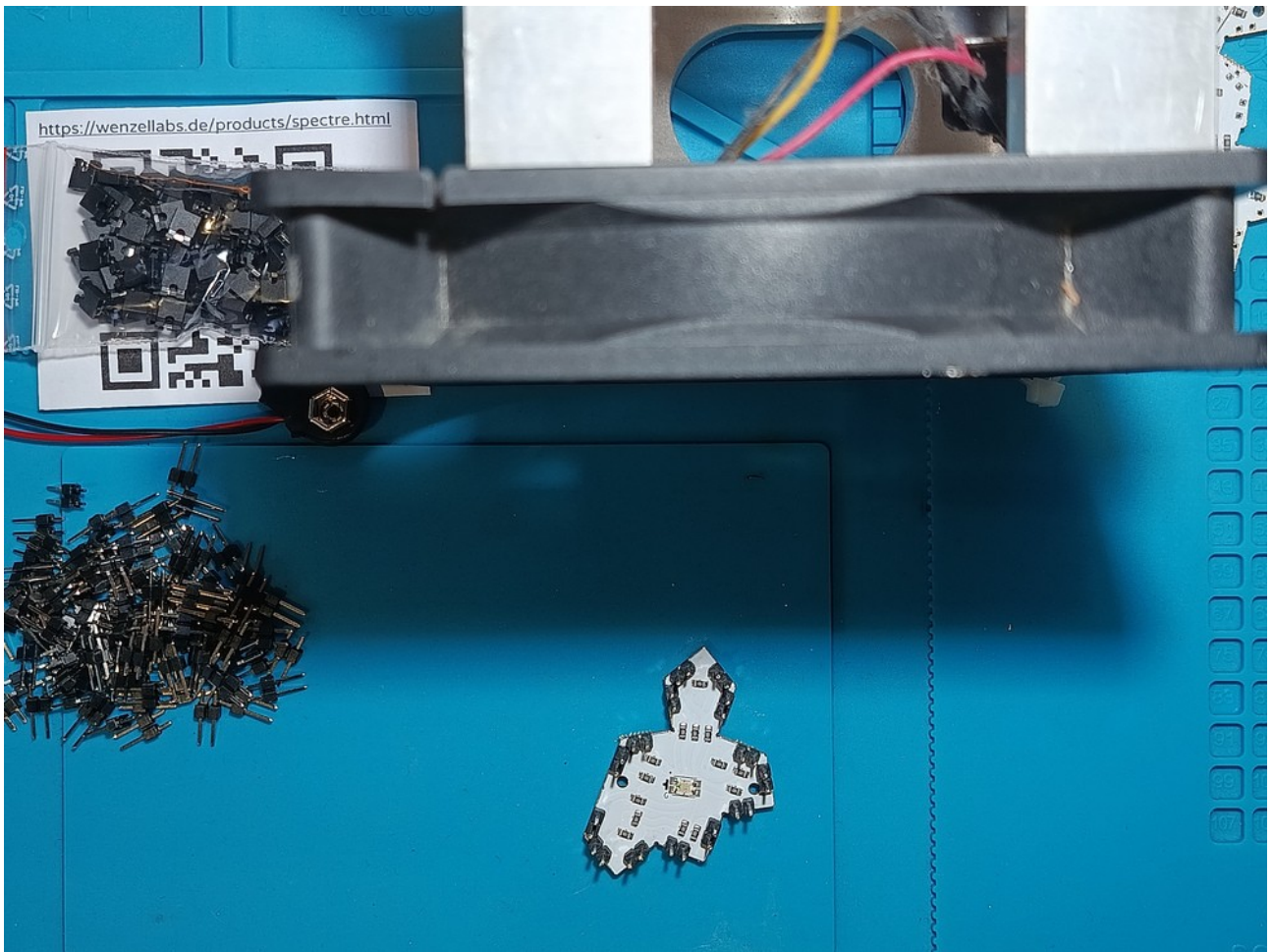
flip over.



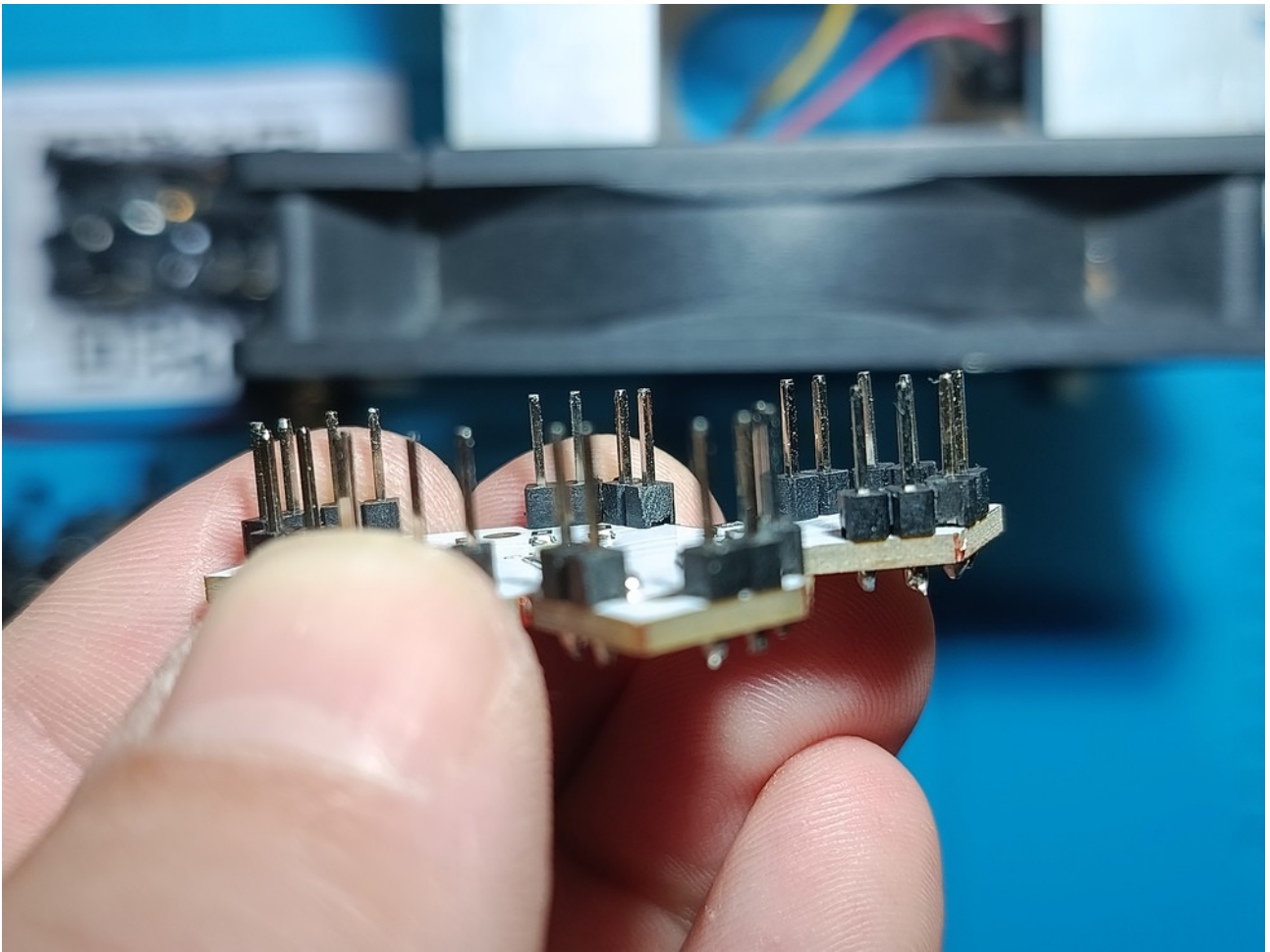
solder. some pins may fall out. don't worry, you still have a lot of training ahead.



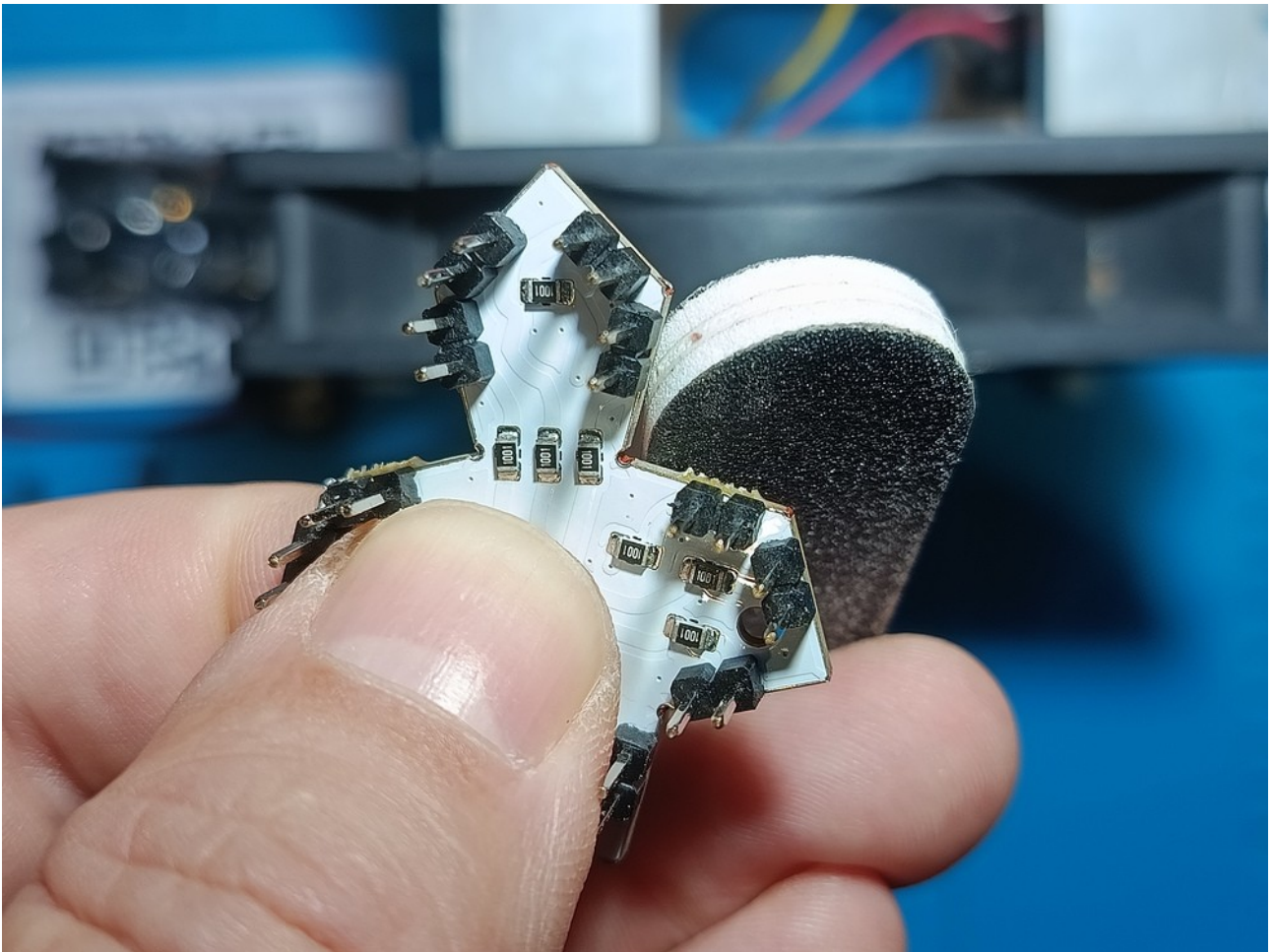
all pins solderes.



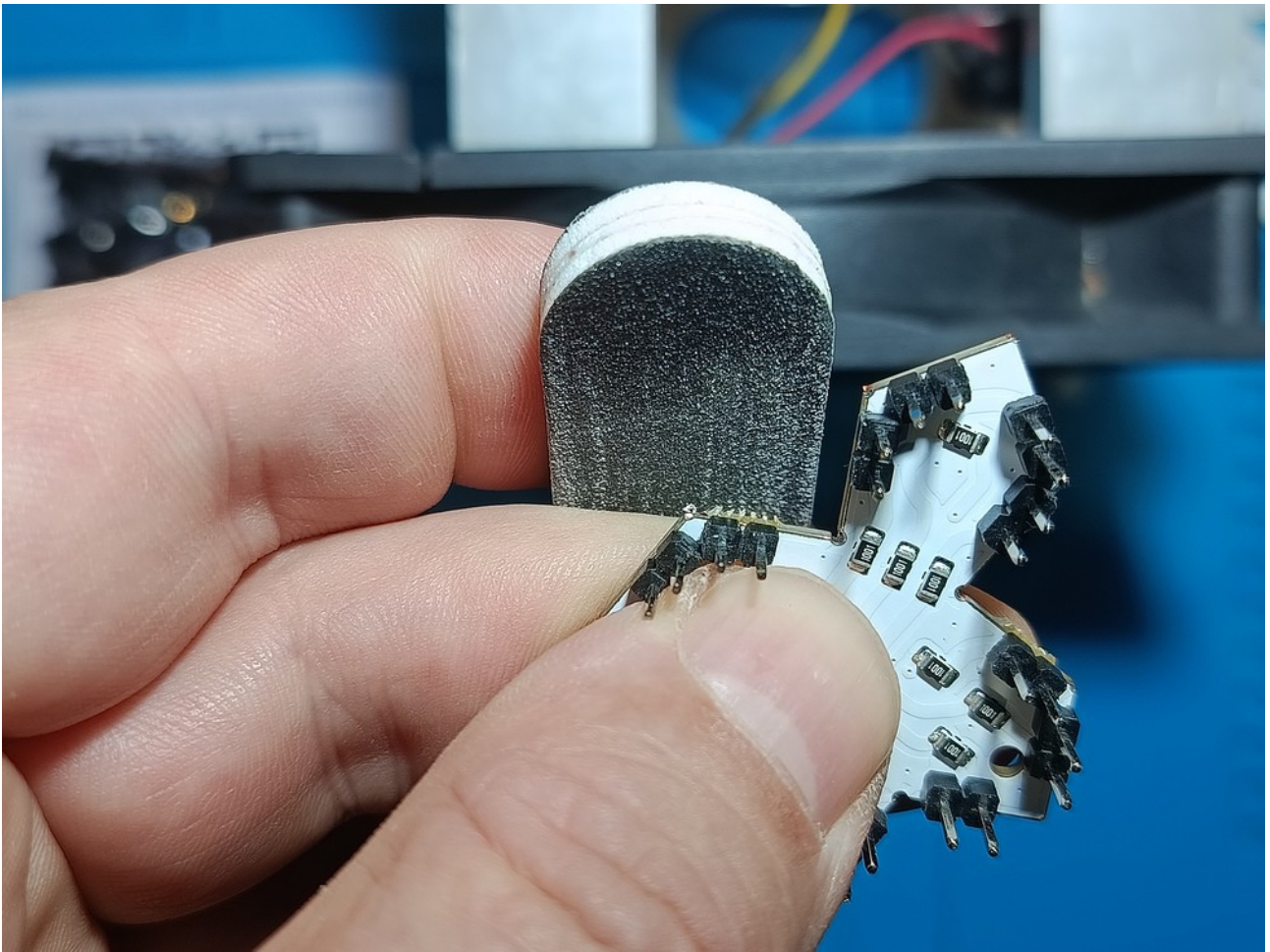
spectre one done.



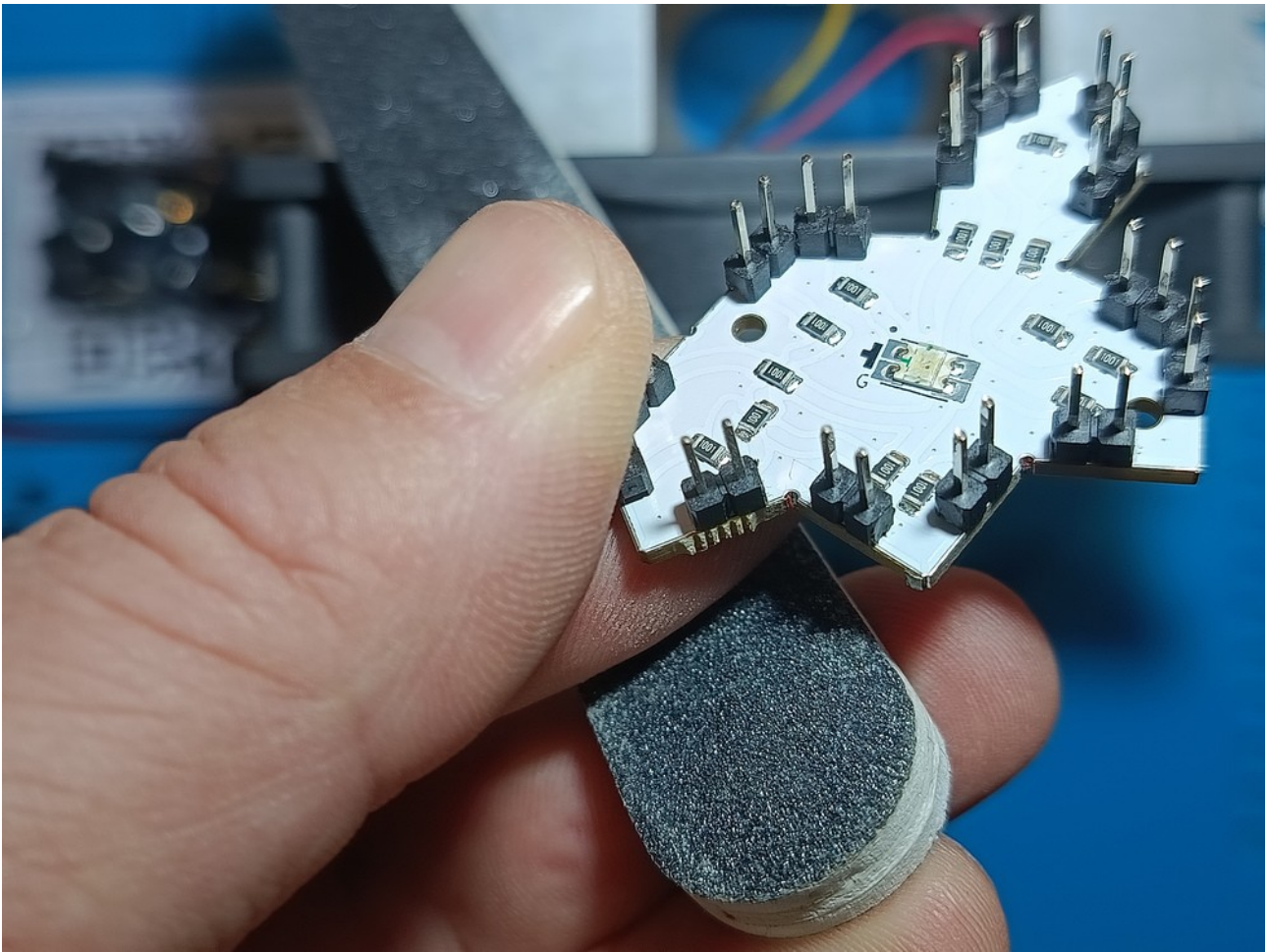
verify the pins all sit flush.



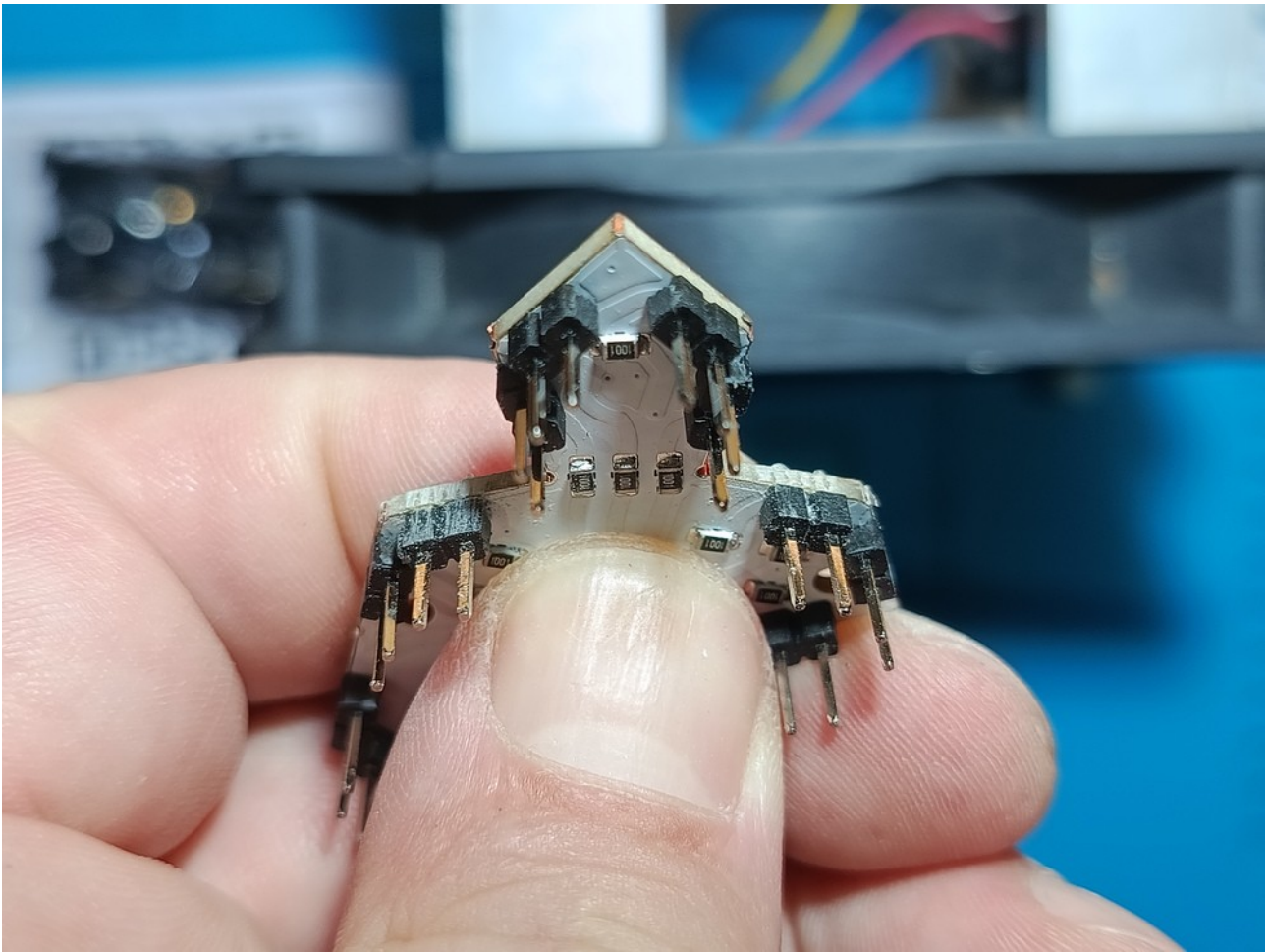
now is a good time to sand down these small so-called mouse-bites. you see these perforated dents at the shoulders of the spectre? those should be sanded away. either using sandpaper, or a nail file..



the perforation on the other shoulder.



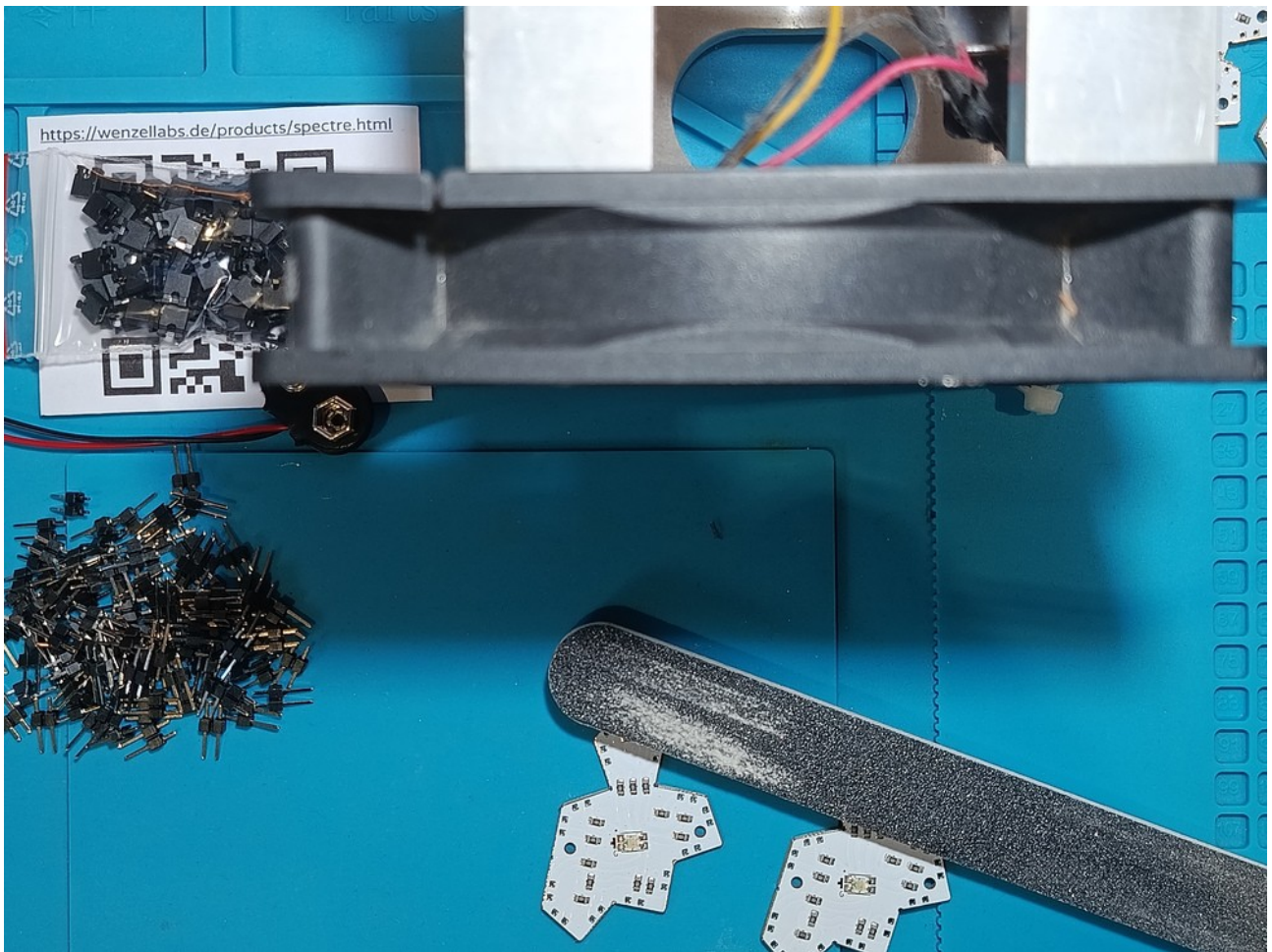
and one more on the bottom.



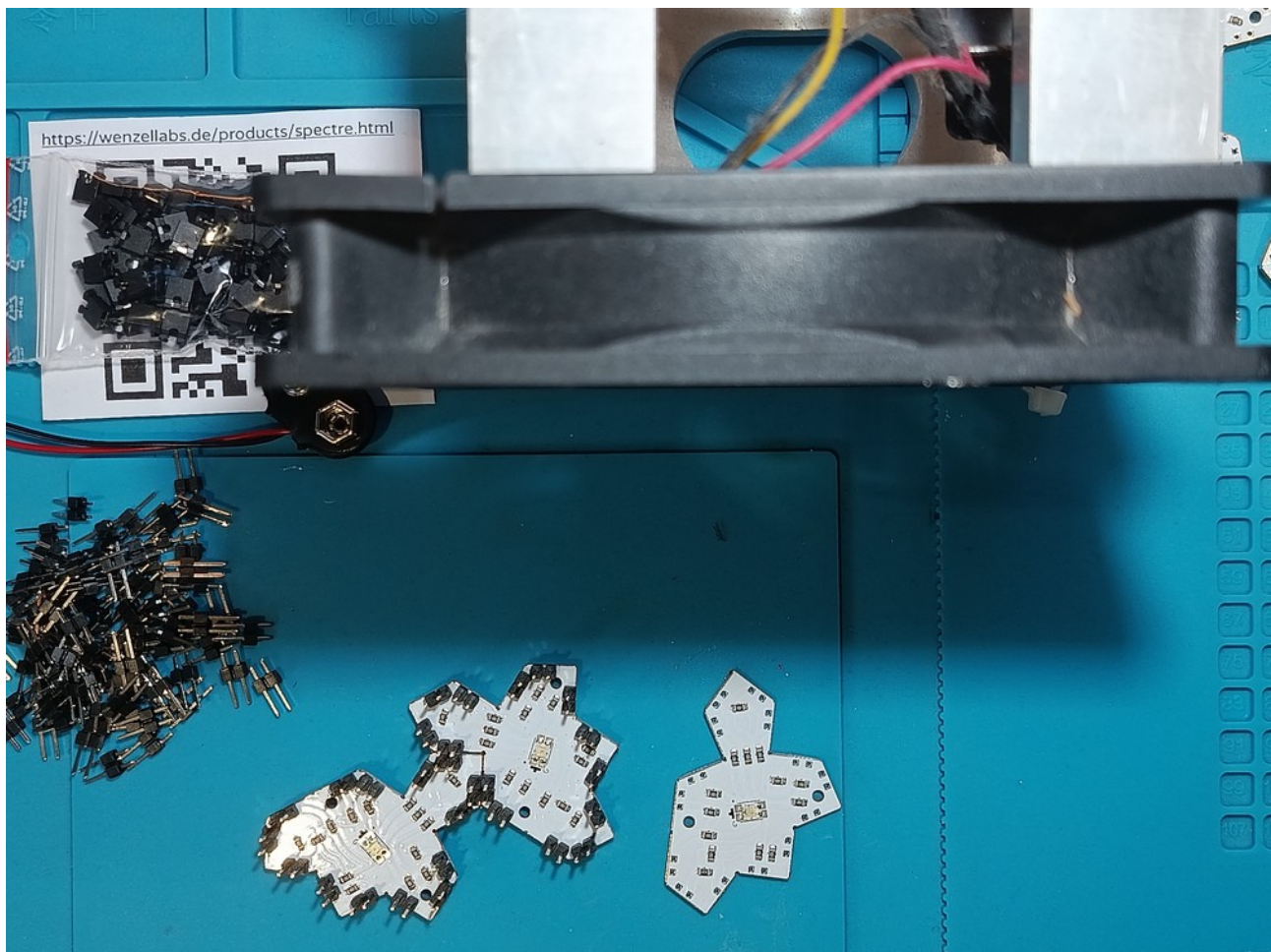
doesn't need to be perfect, just so that the spiky edges be gone.



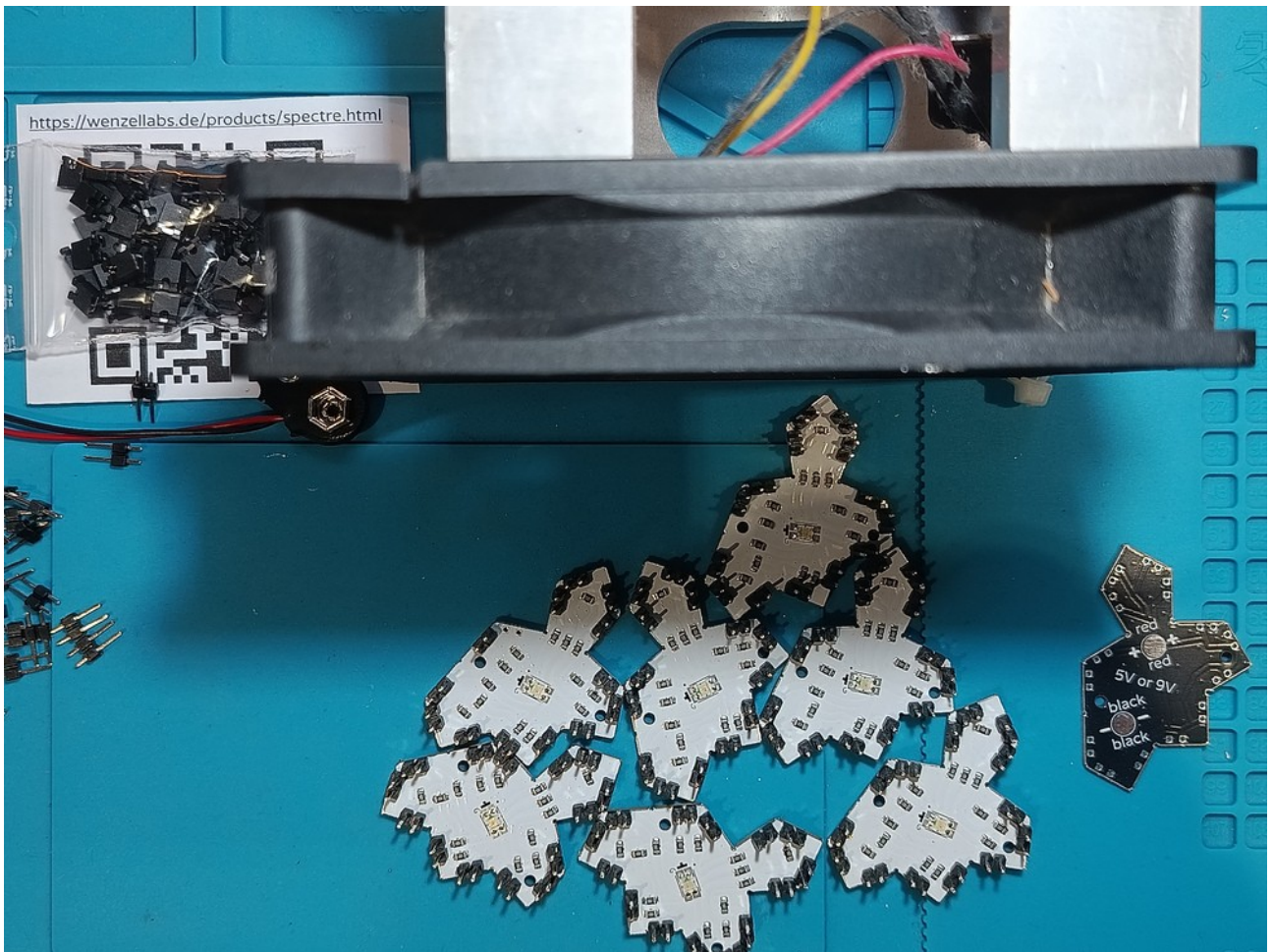
you should wear a mask while filing, the board material contains fiber glass which wou don't want to breathe in.



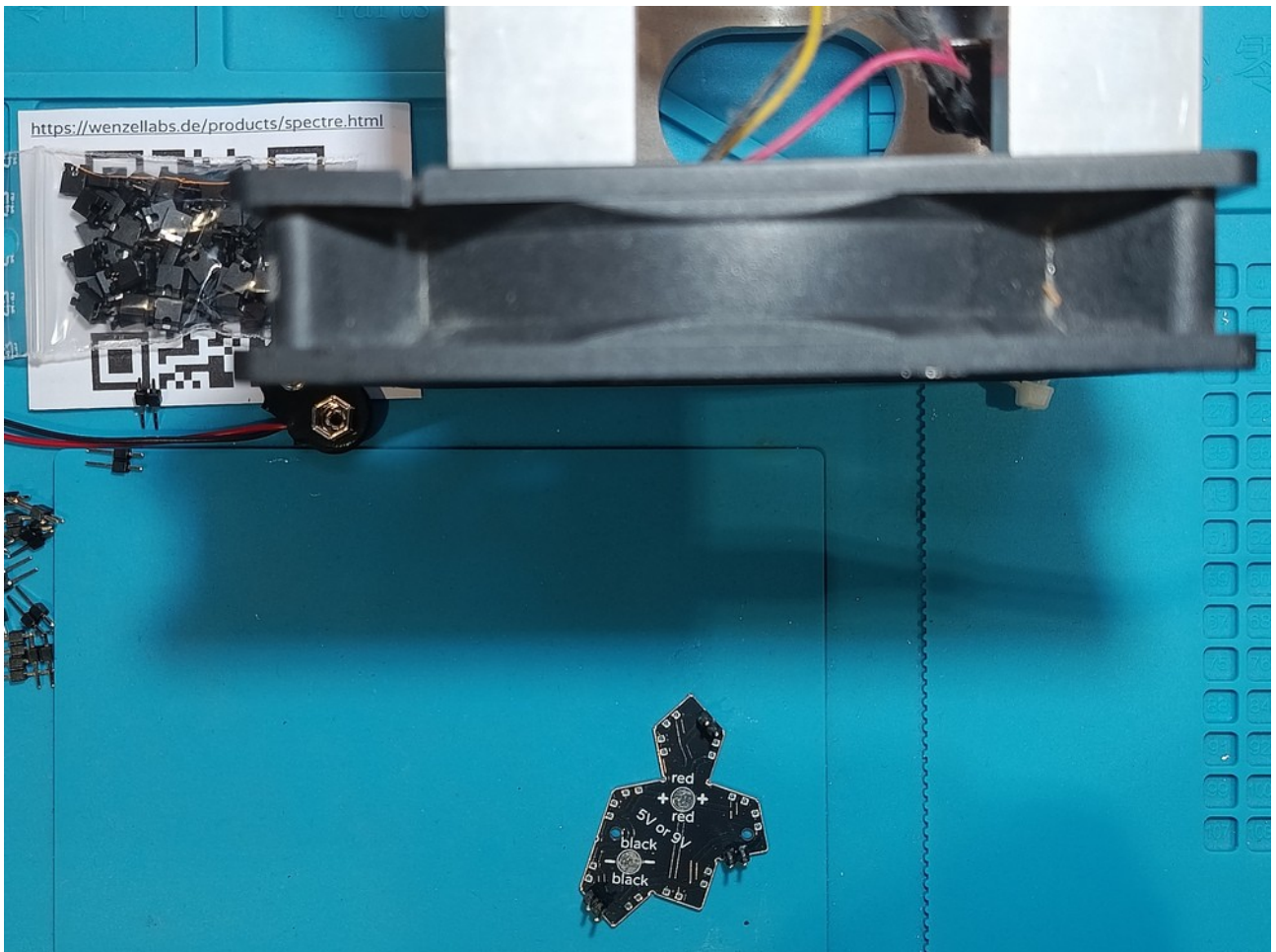
you probably want to file them all in one go, before or after soldering doesn't really matter.



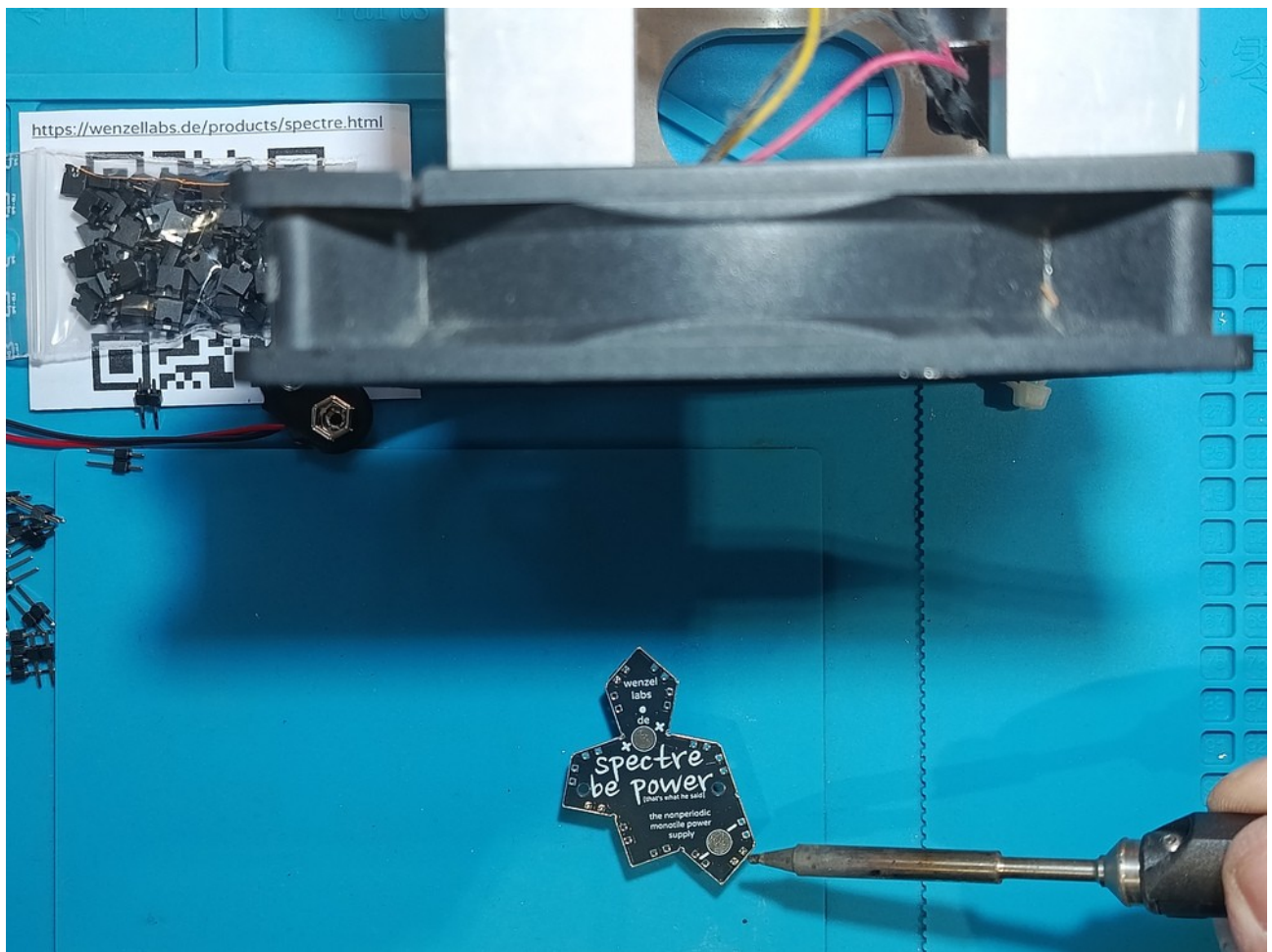
now back to soldering. solder all the pins of all the remaining white spectre tiles.



we're getting somewhere.



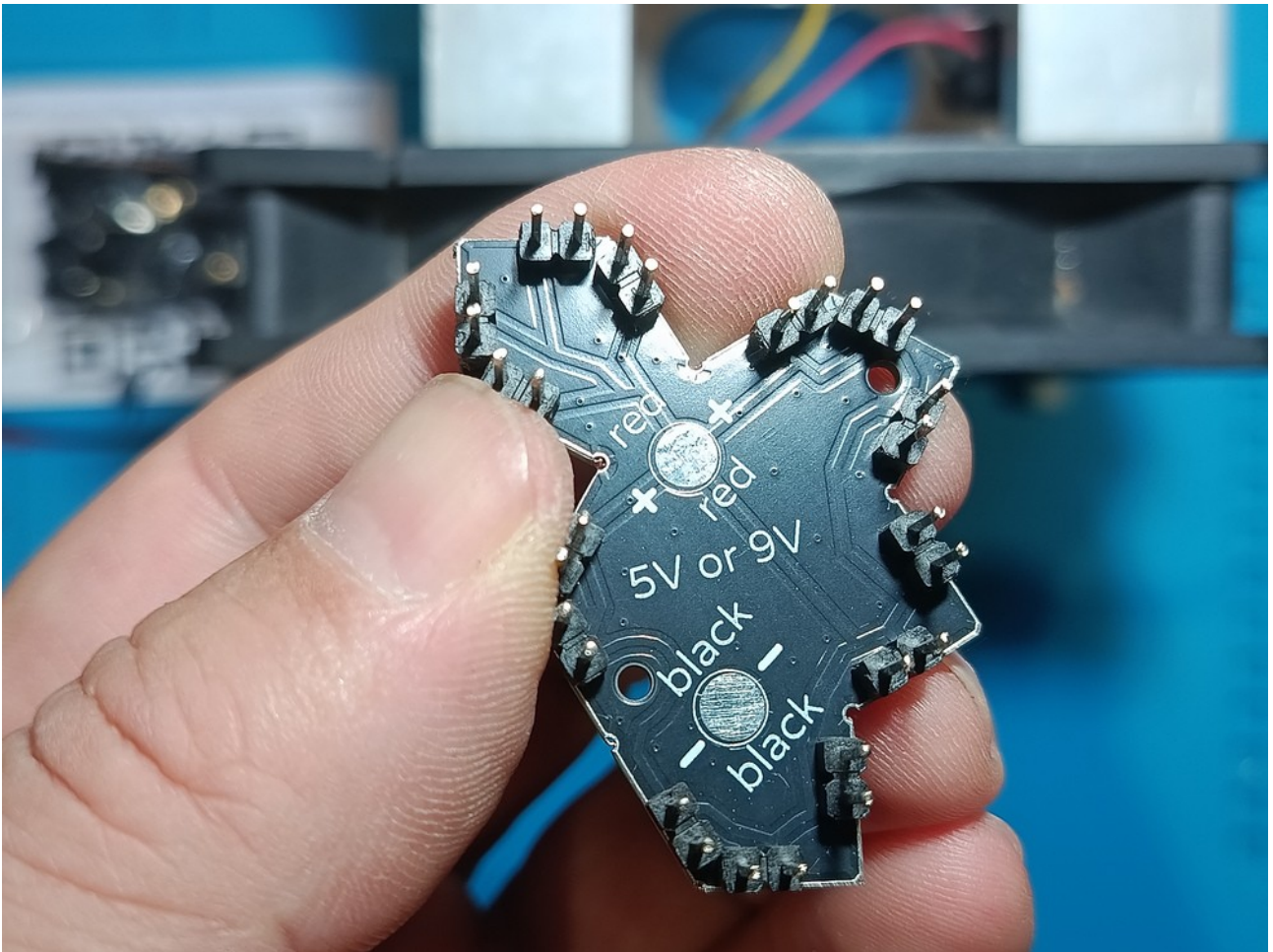
now the black spectre be power tile also gets its 14 01x02 pins. insert them from the side shown, and solder from the backside where “spectre be power” is printed on.



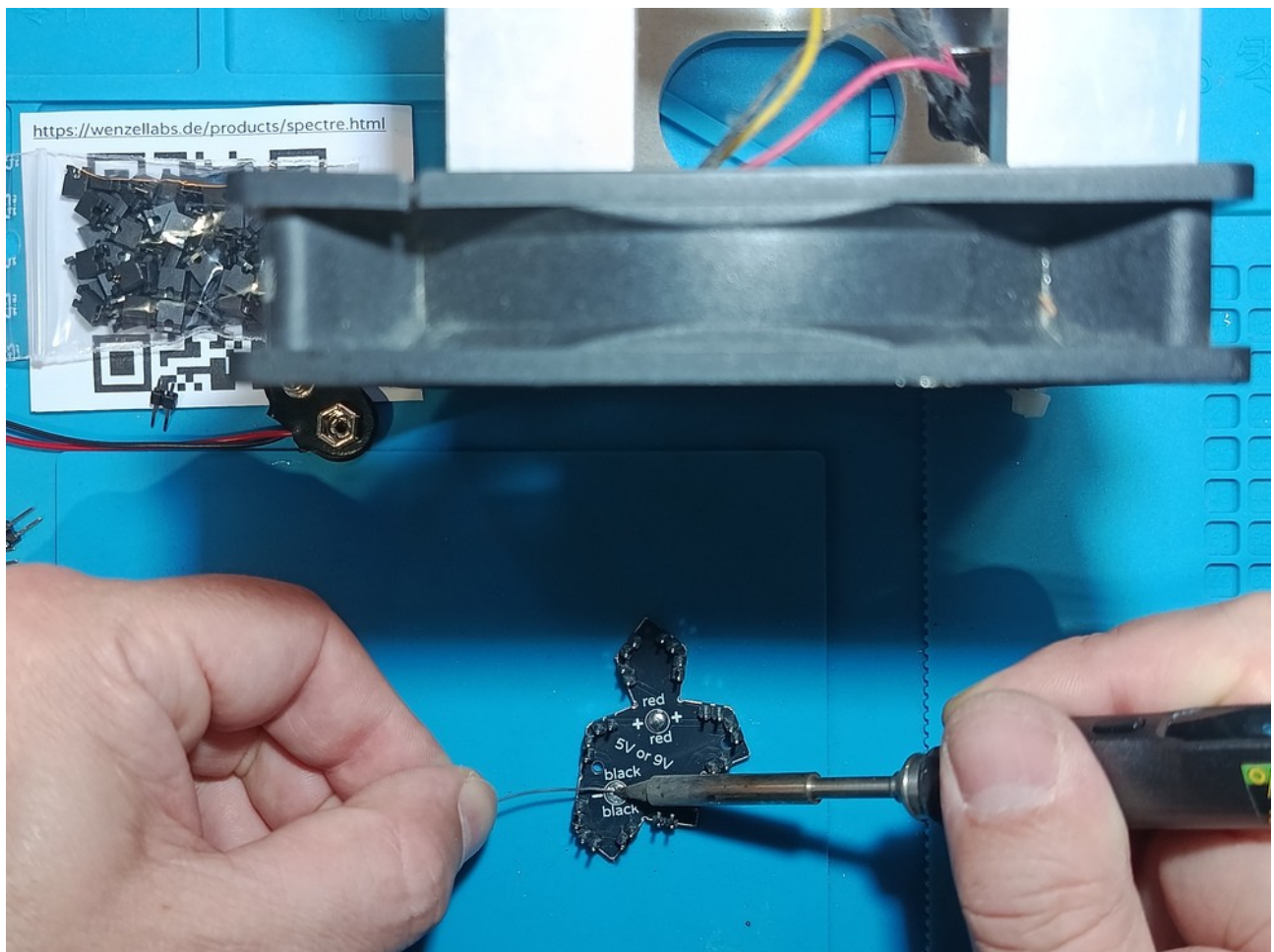
again, start with 3 pins, then the rest.



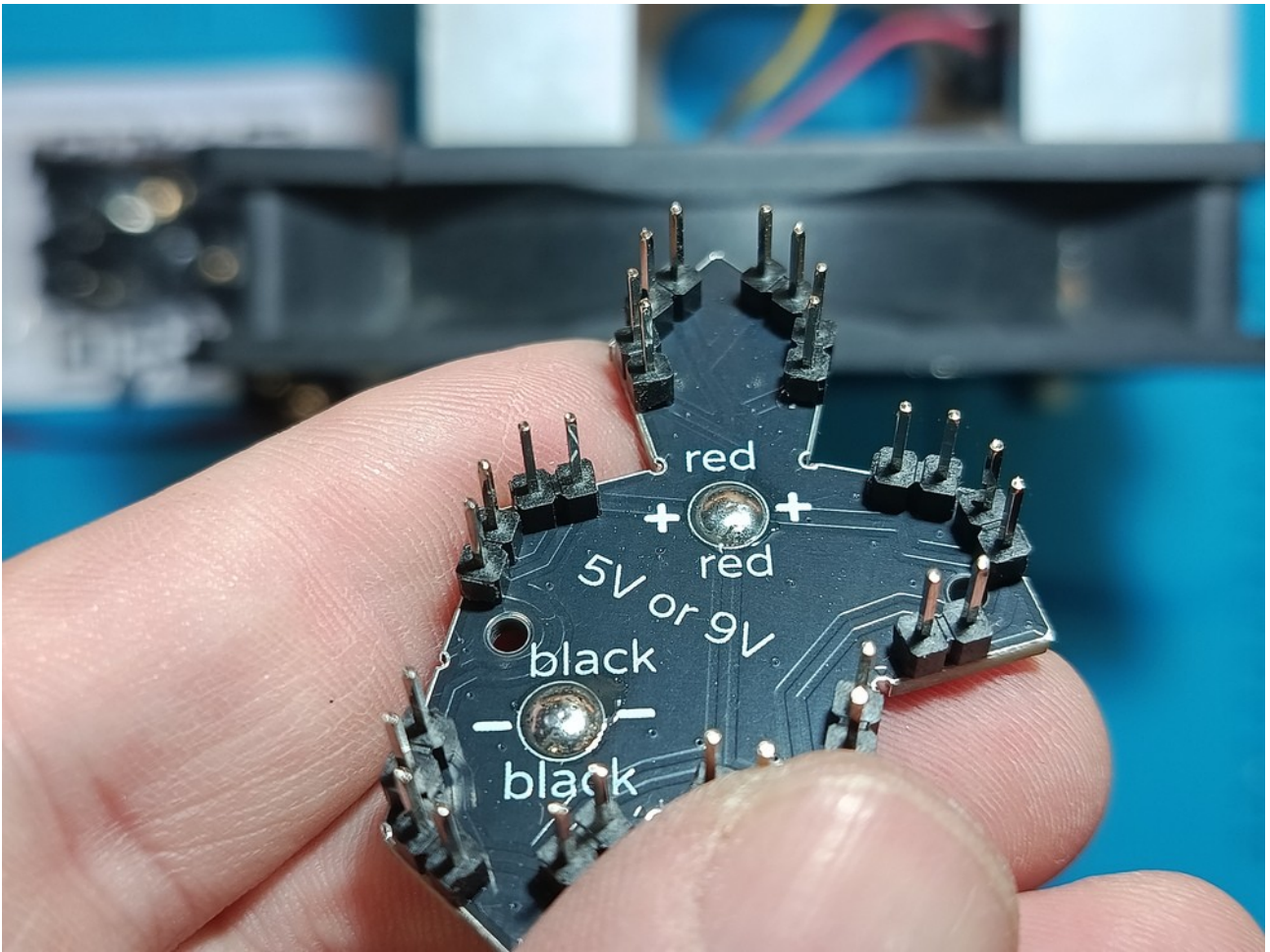
done.



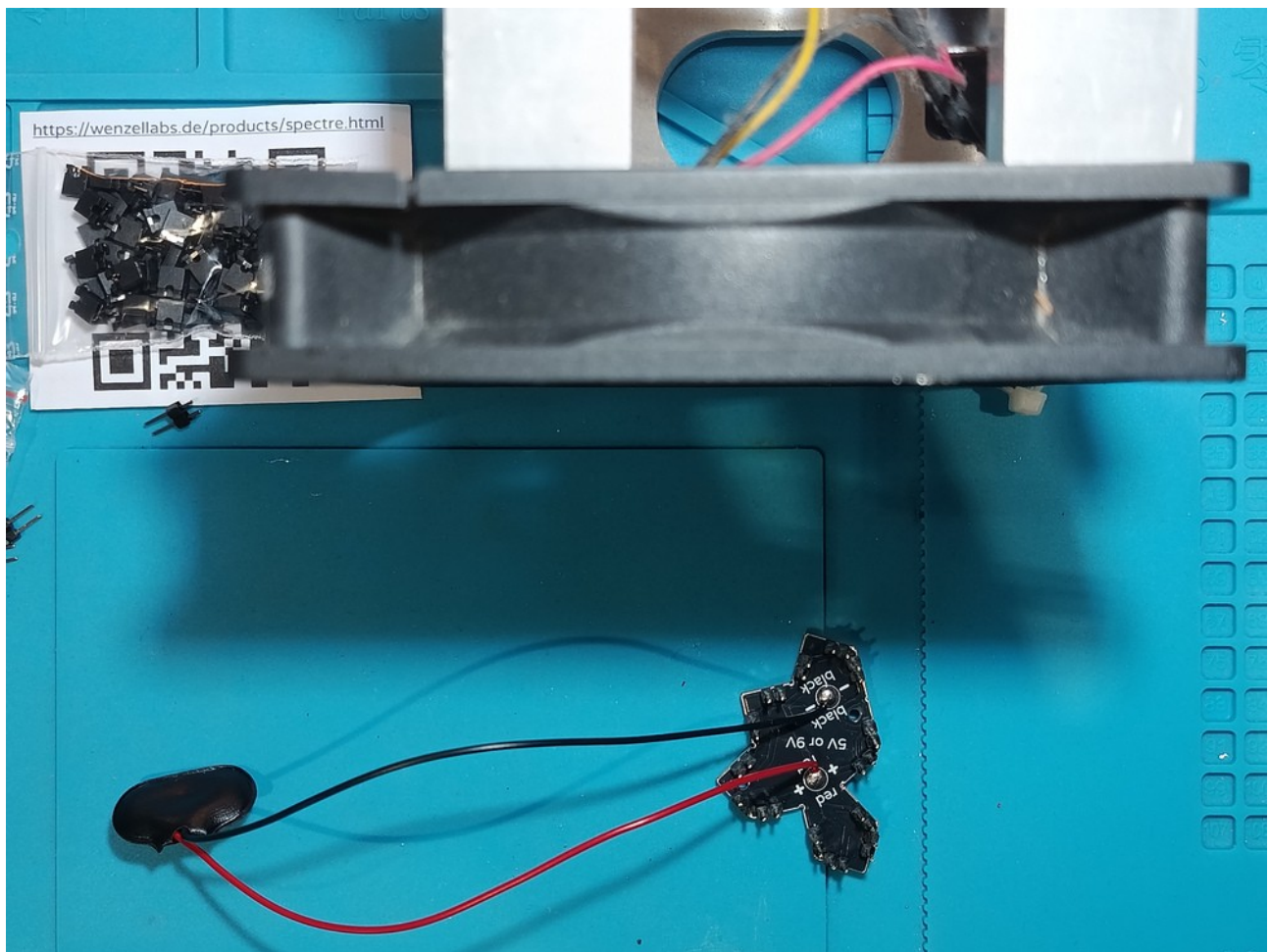
now only the battery connection is missing.



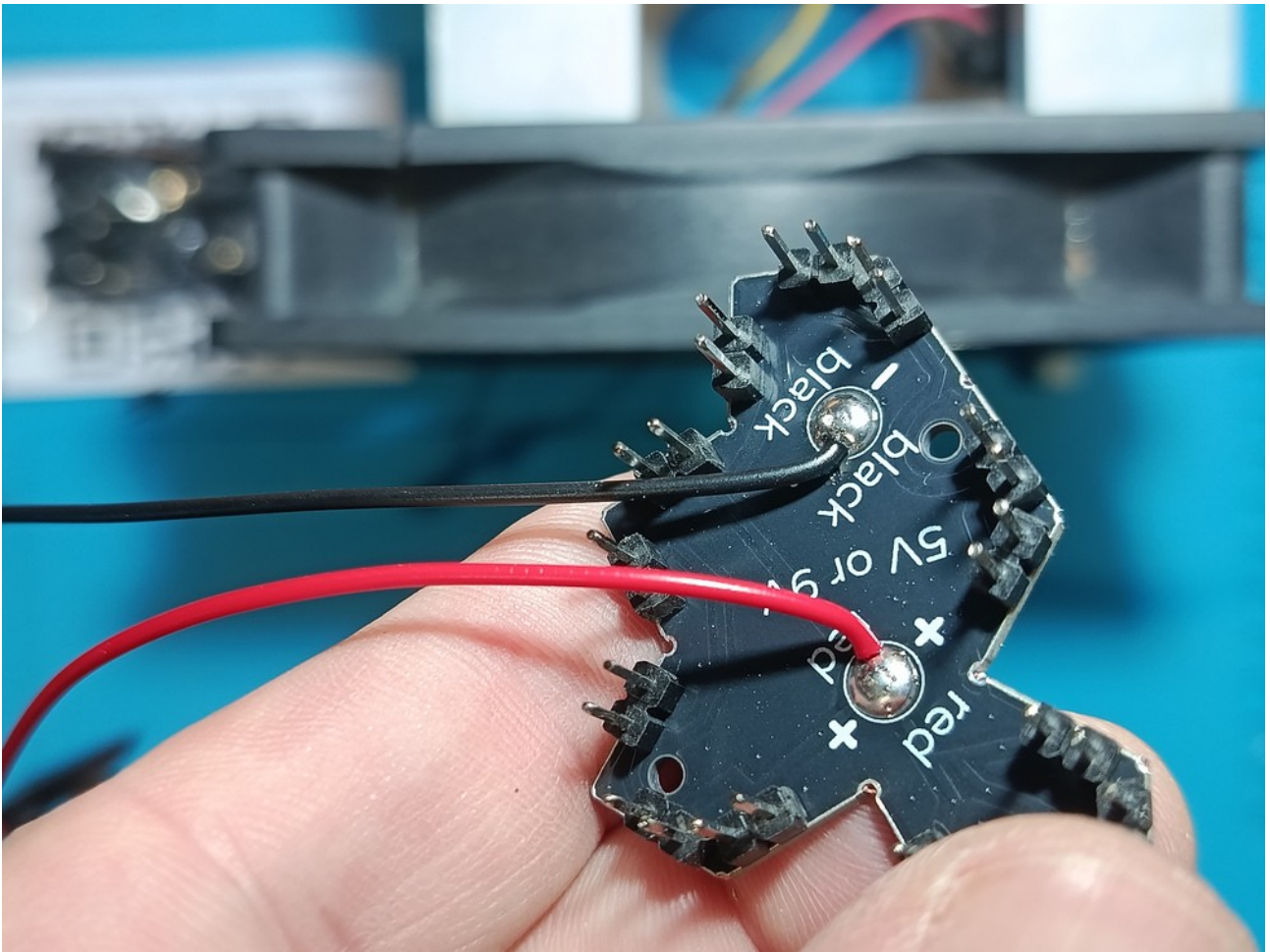
I like to add two round humps of solder on the to connection points red and black.



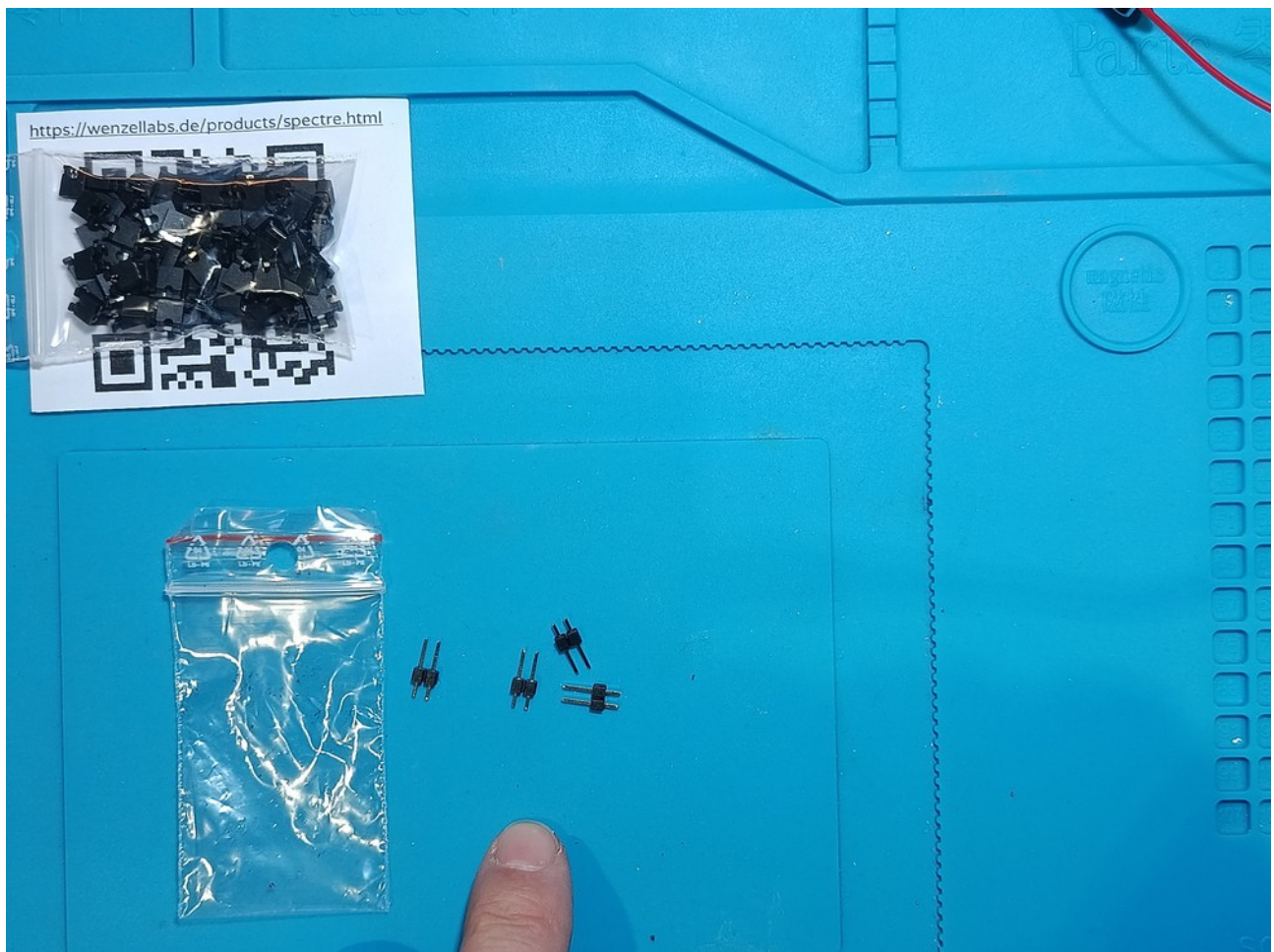
like so.



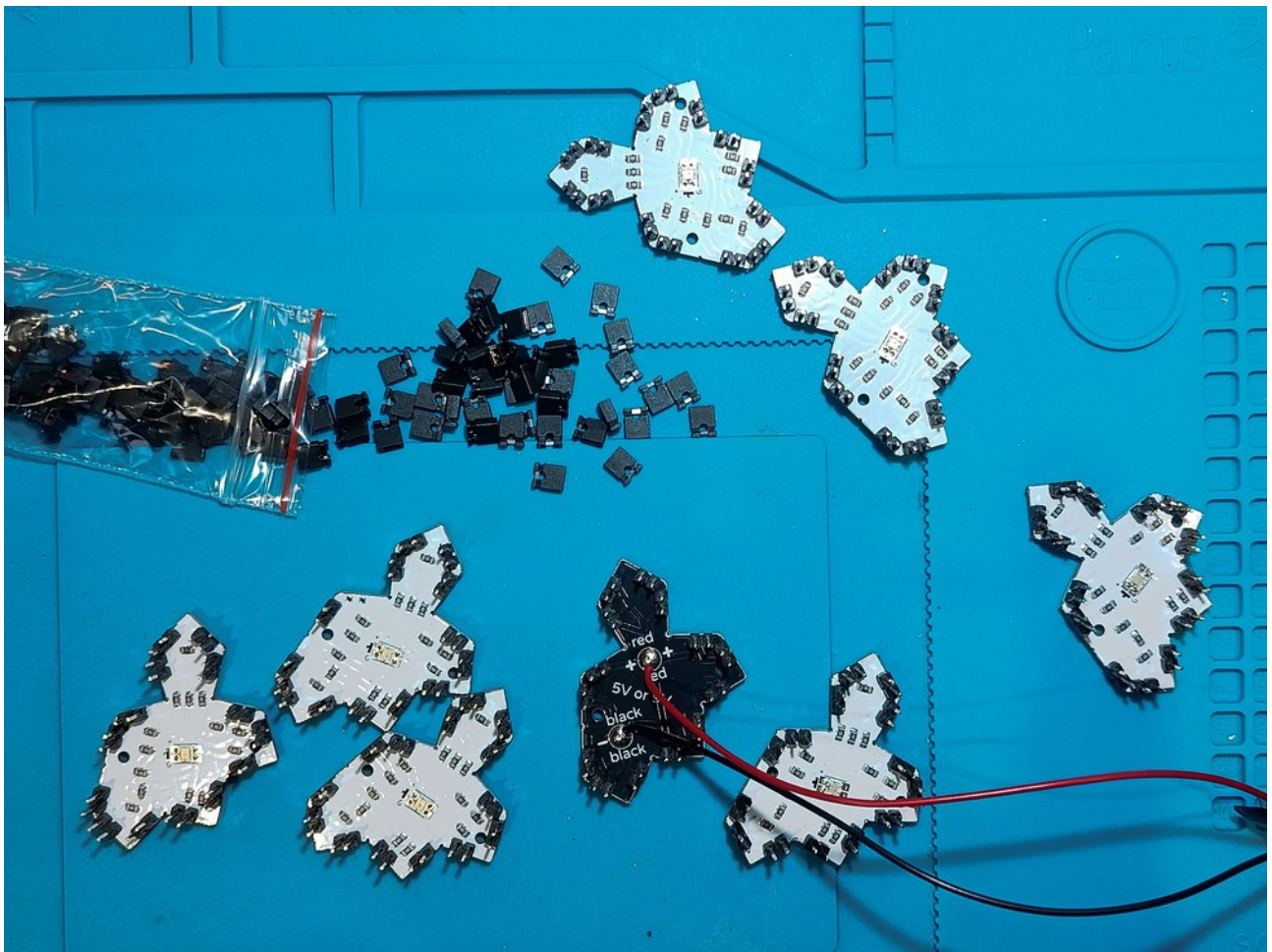
then just re-heat and insert the wire.



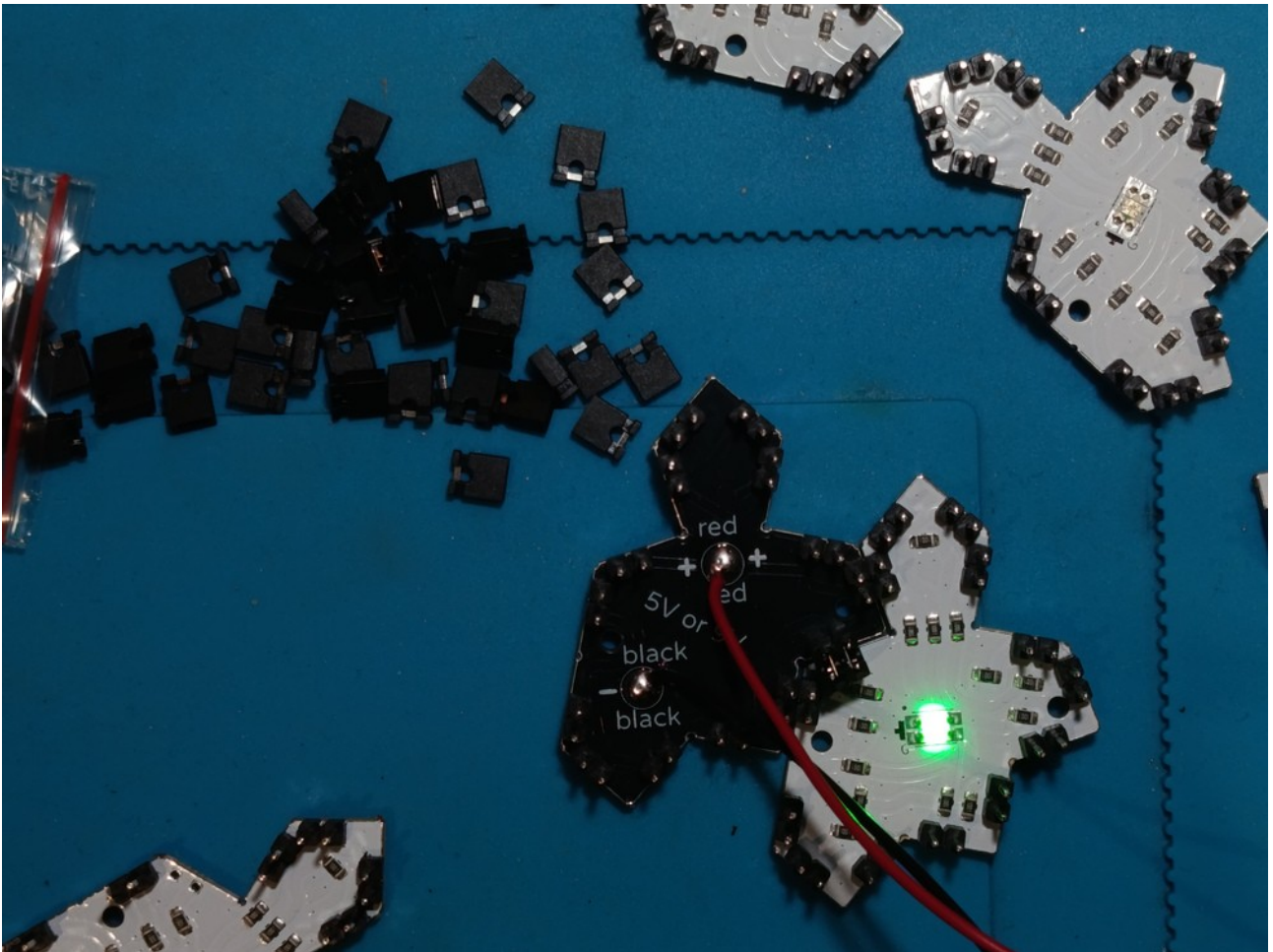
soldering done \o/.



the leftovers are the start into your upcoming creative projects!



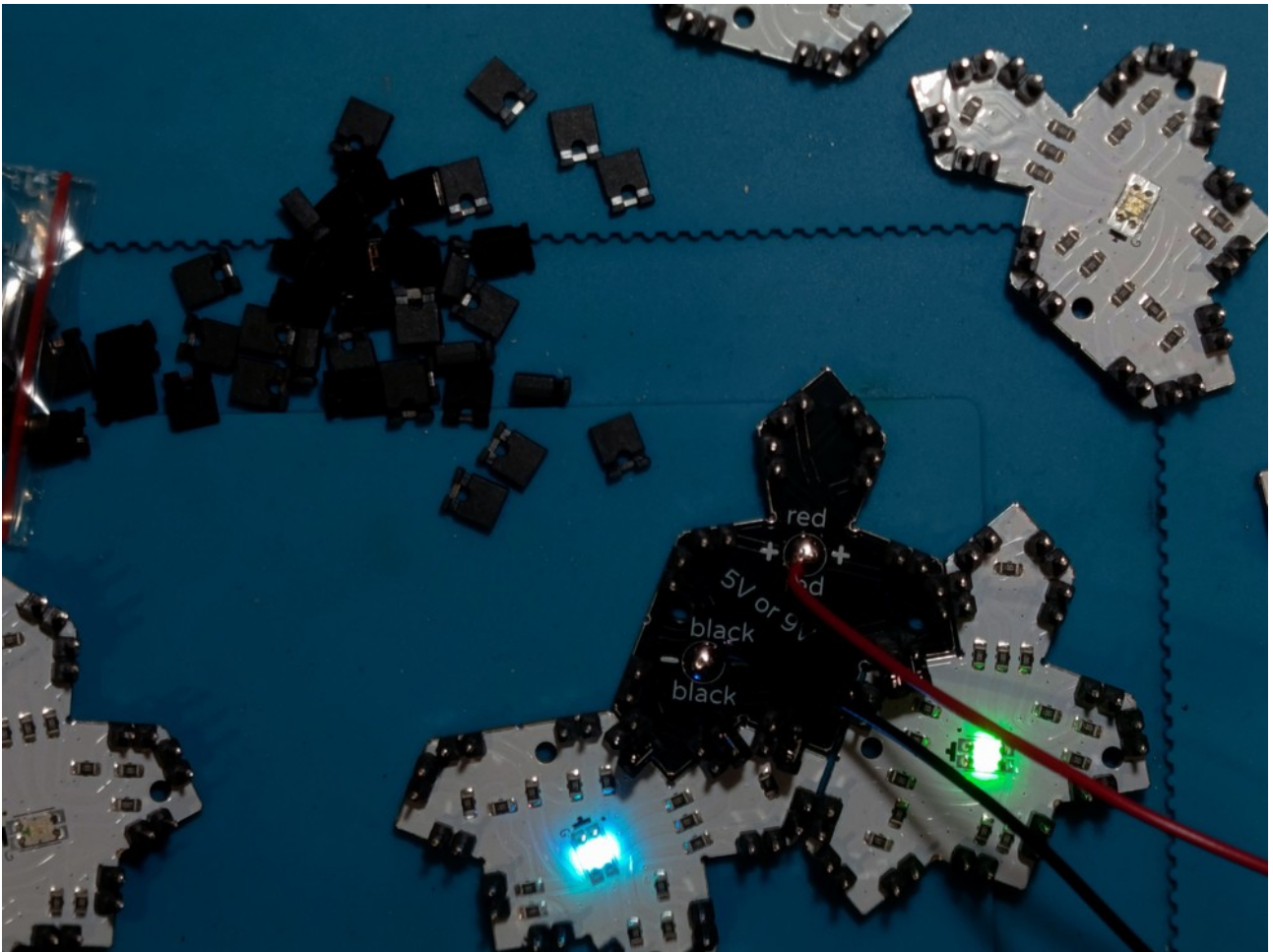
start puzzling, and add jumpers to make mechanical and electrical connections between the tiles.



lights out!

add some jumpers. not all are required or recommended, starting with the black center tile I'd add most though. and thin them out outwards, but you can start your own research.

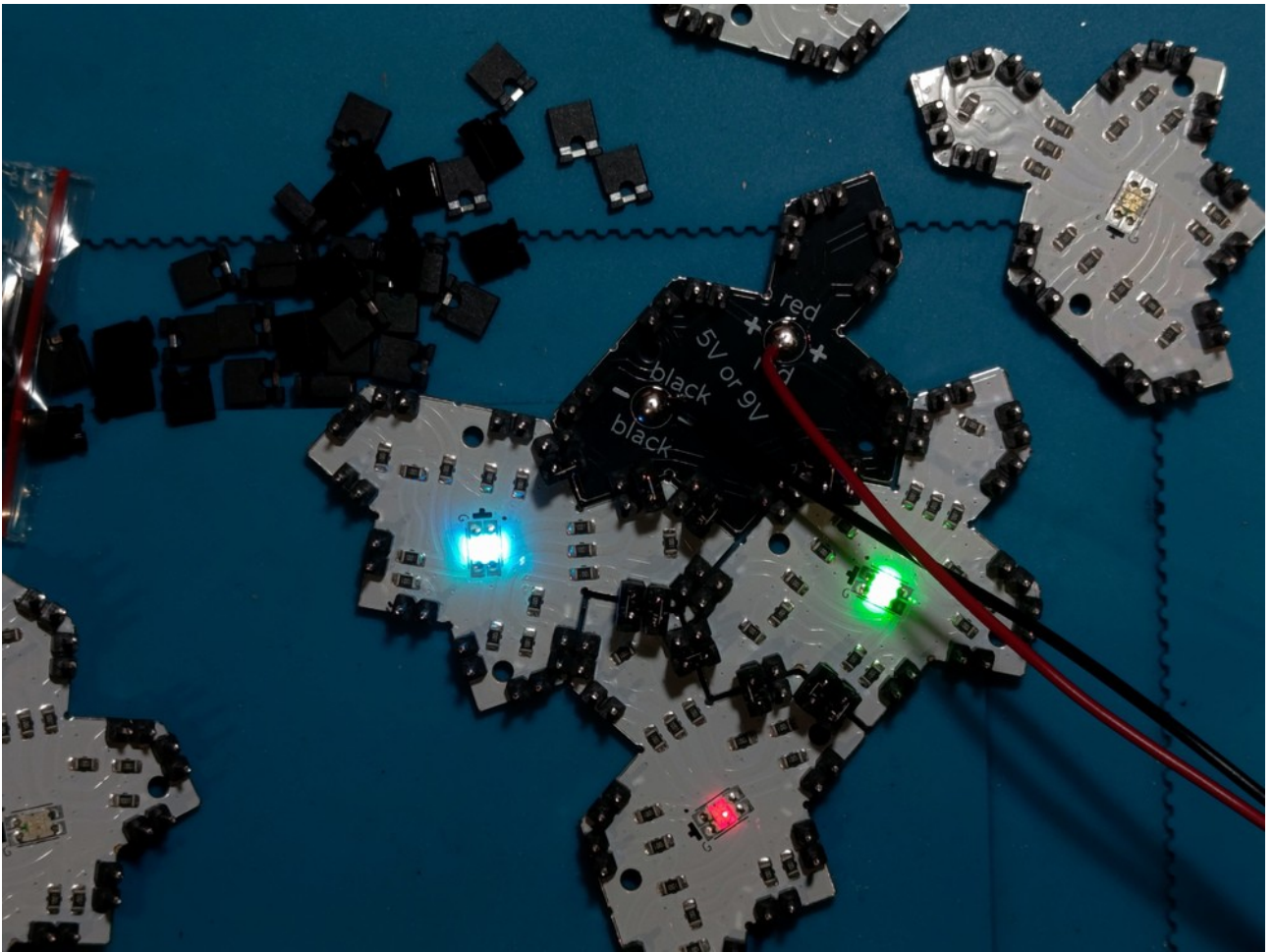
always add the jumpers so they connect two tiles. never place a jumper with both of its holes on one tile.

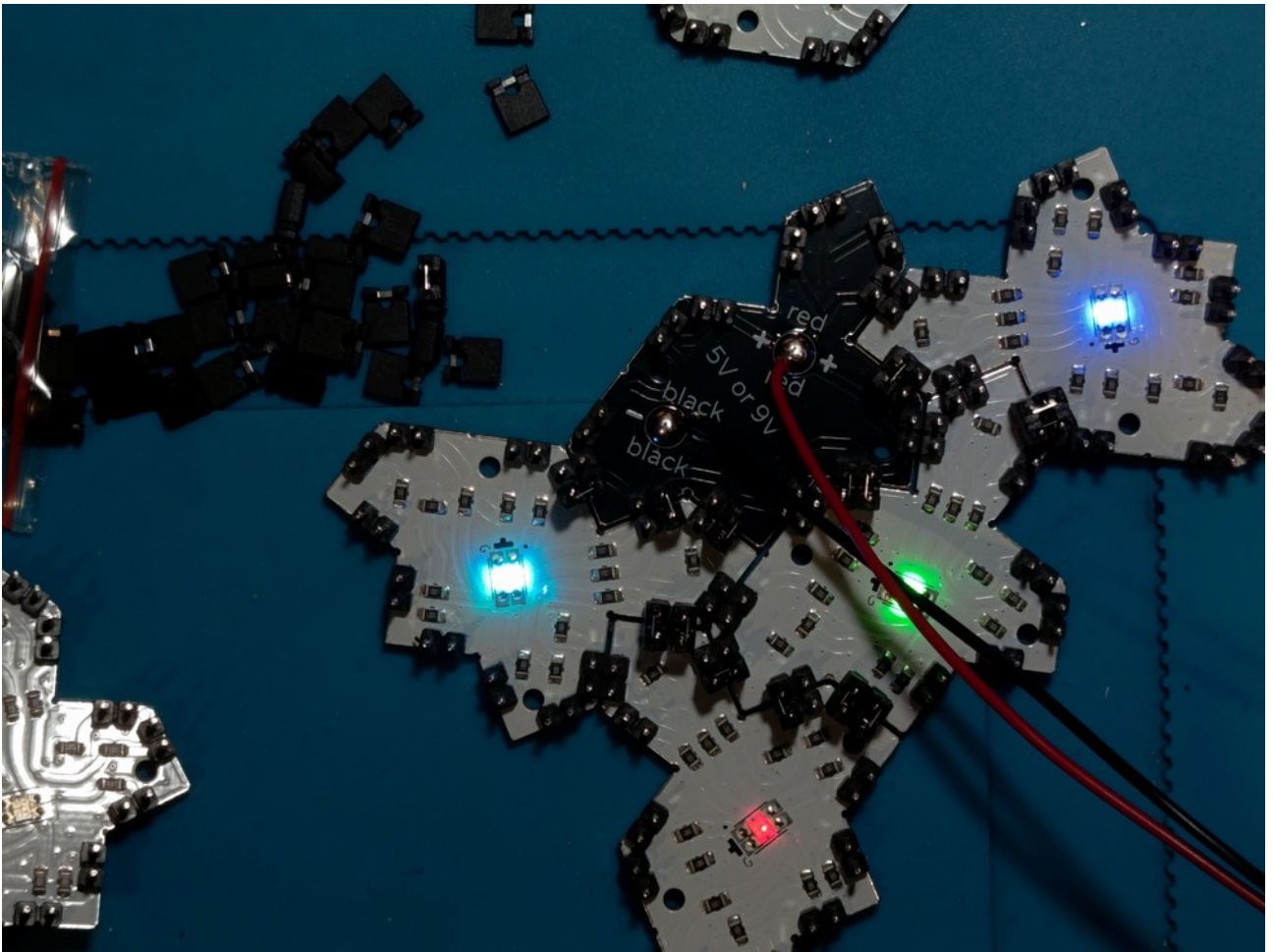


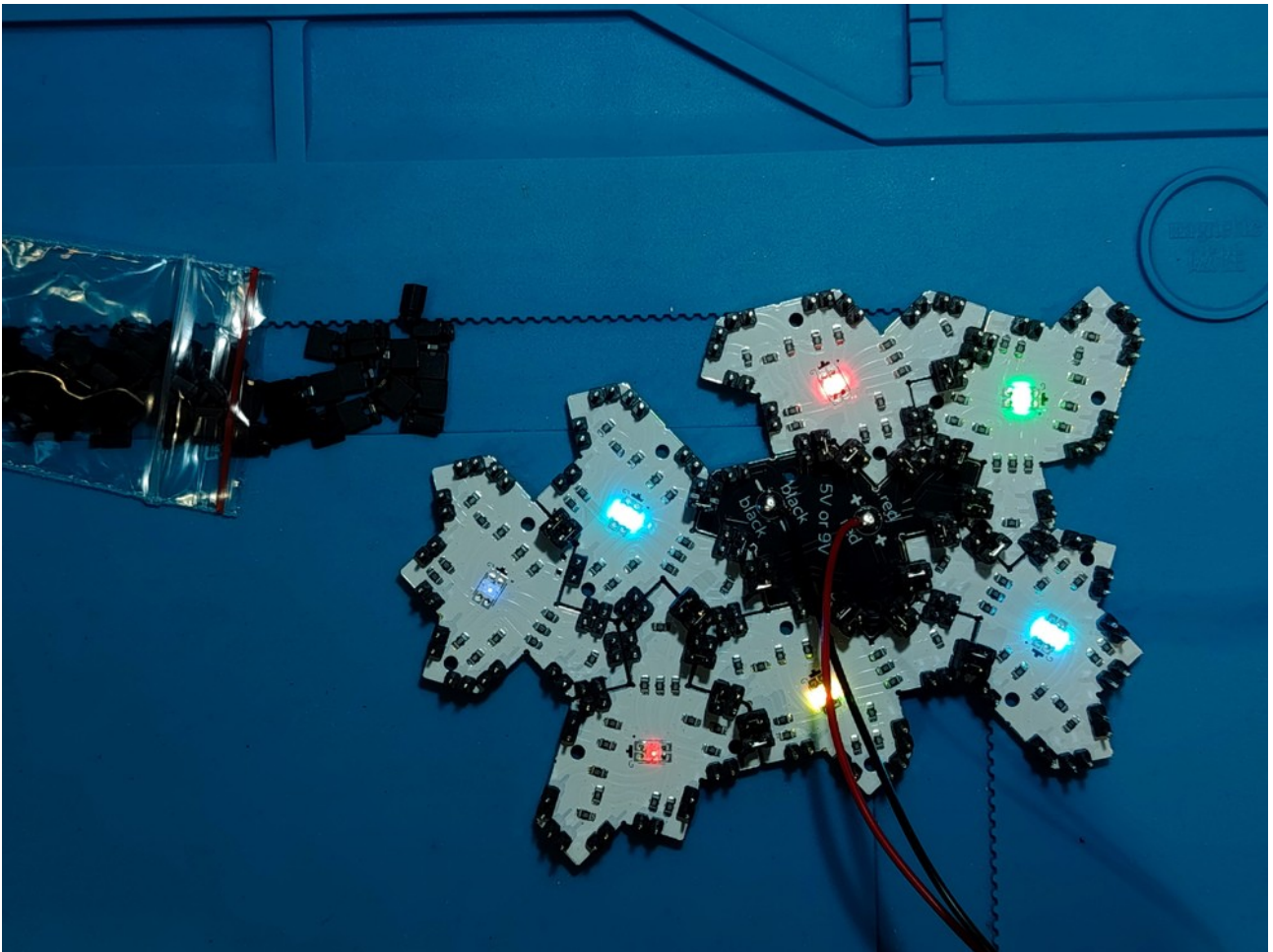
each edge has a pin in the middle M and a pin on the side S.

0-----M-S---0

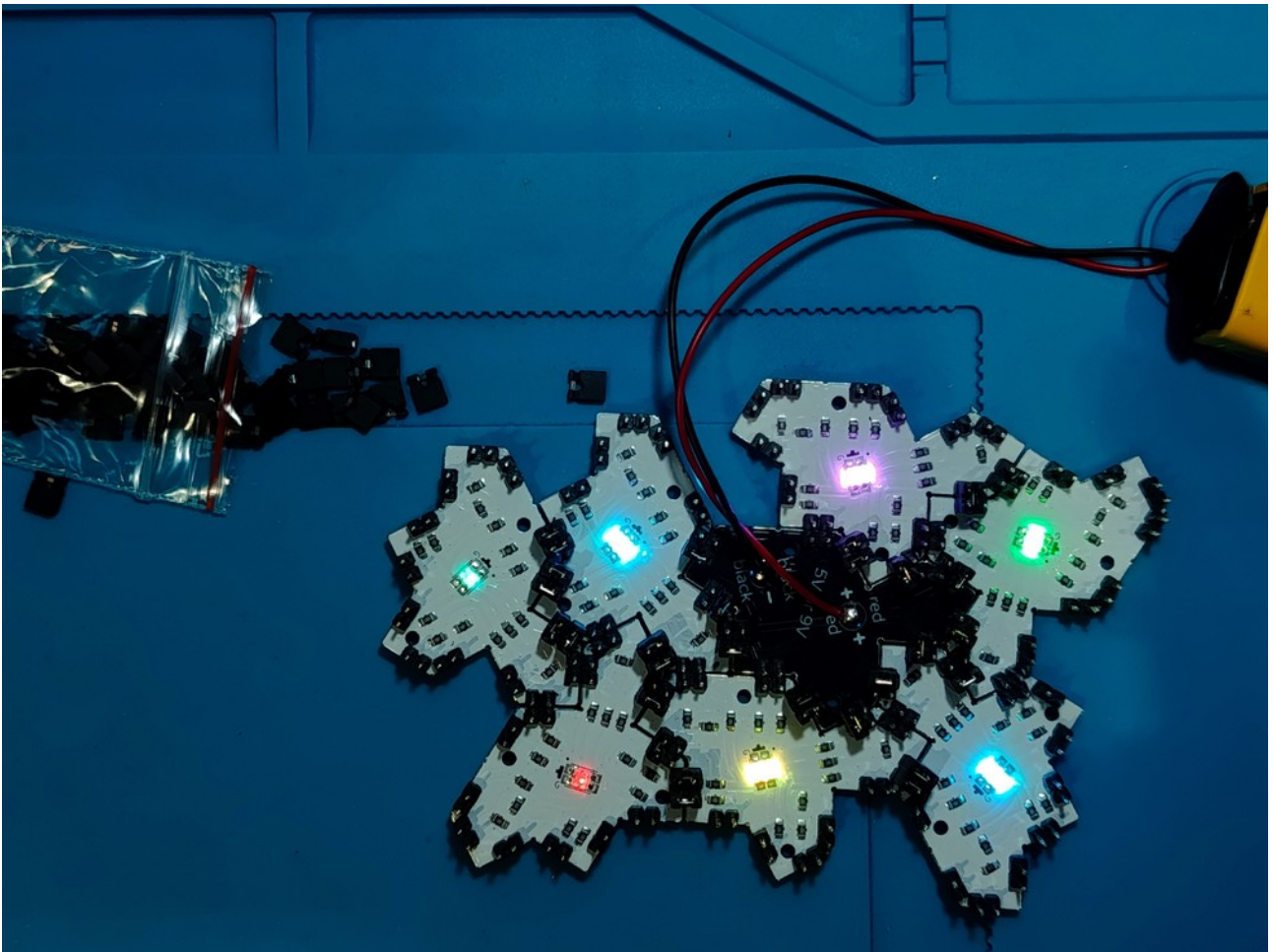
M is one of the colors red, green or blue, and
S is ground or minus



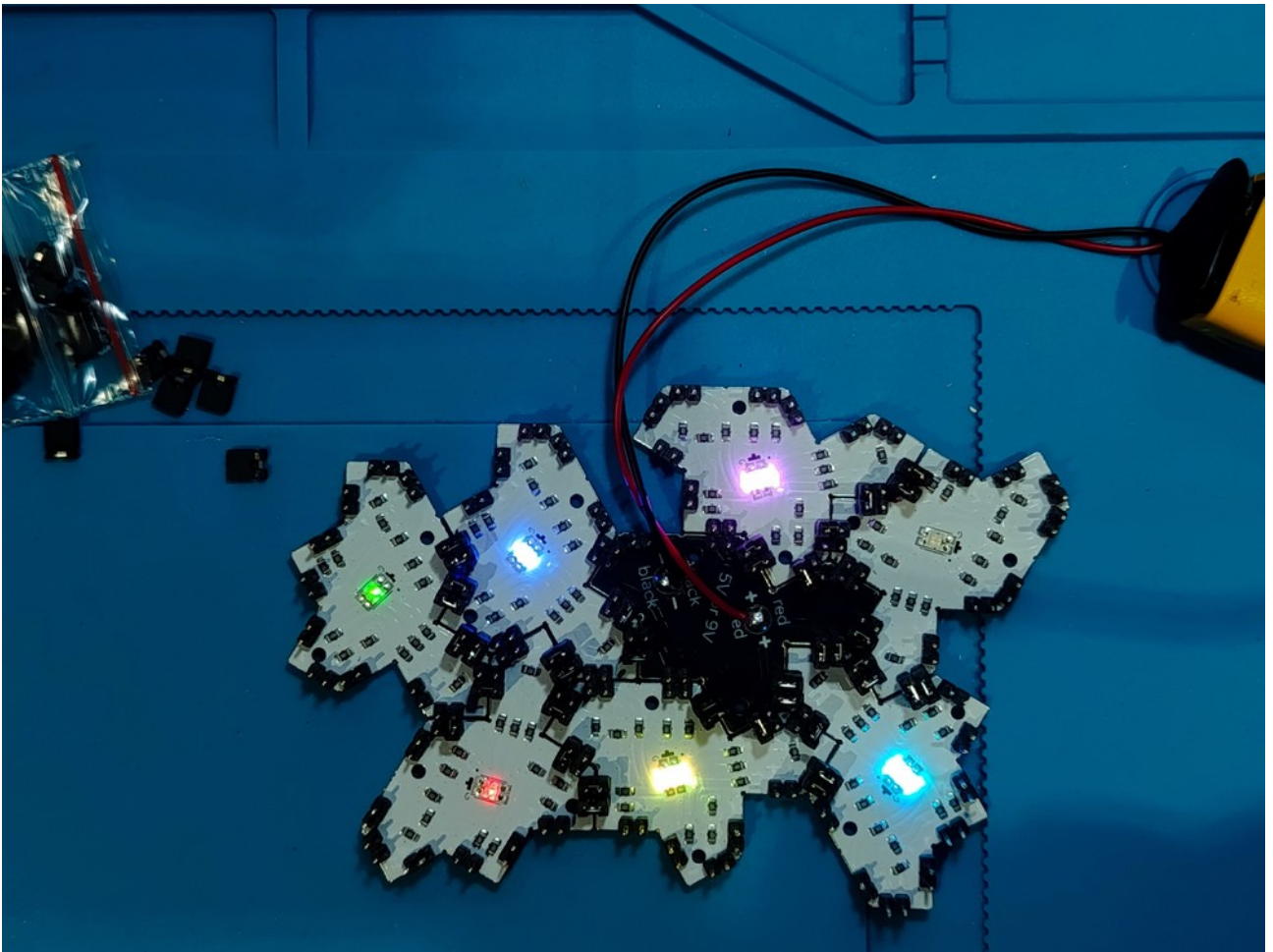




not all puzzles are “valid”. like here, the gap above the black tile cannot be filled by any tile, we need to remove another spectre first to continue.
electrically however this does no harm.



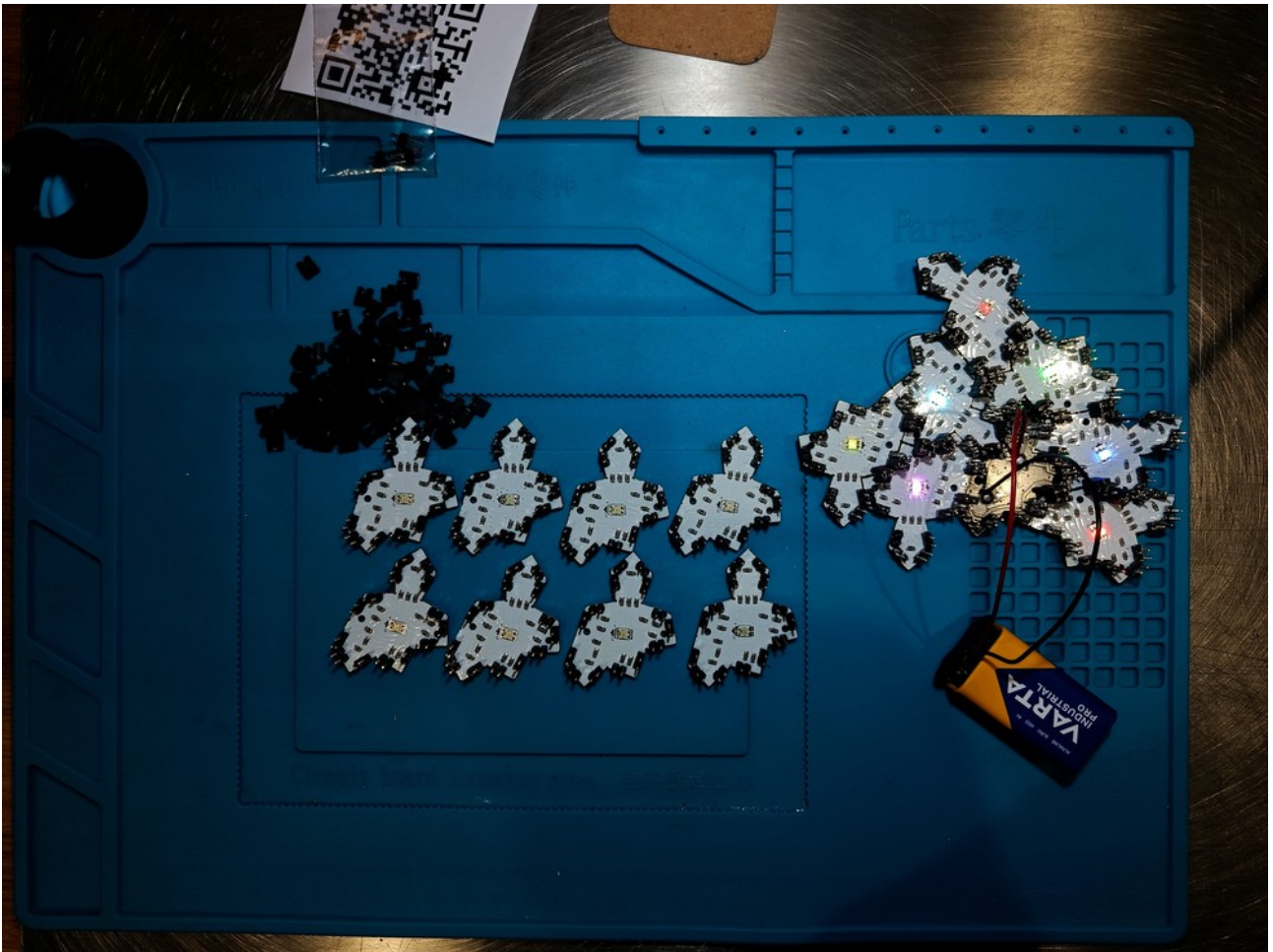
adding and removing jumpers also changes the colots.





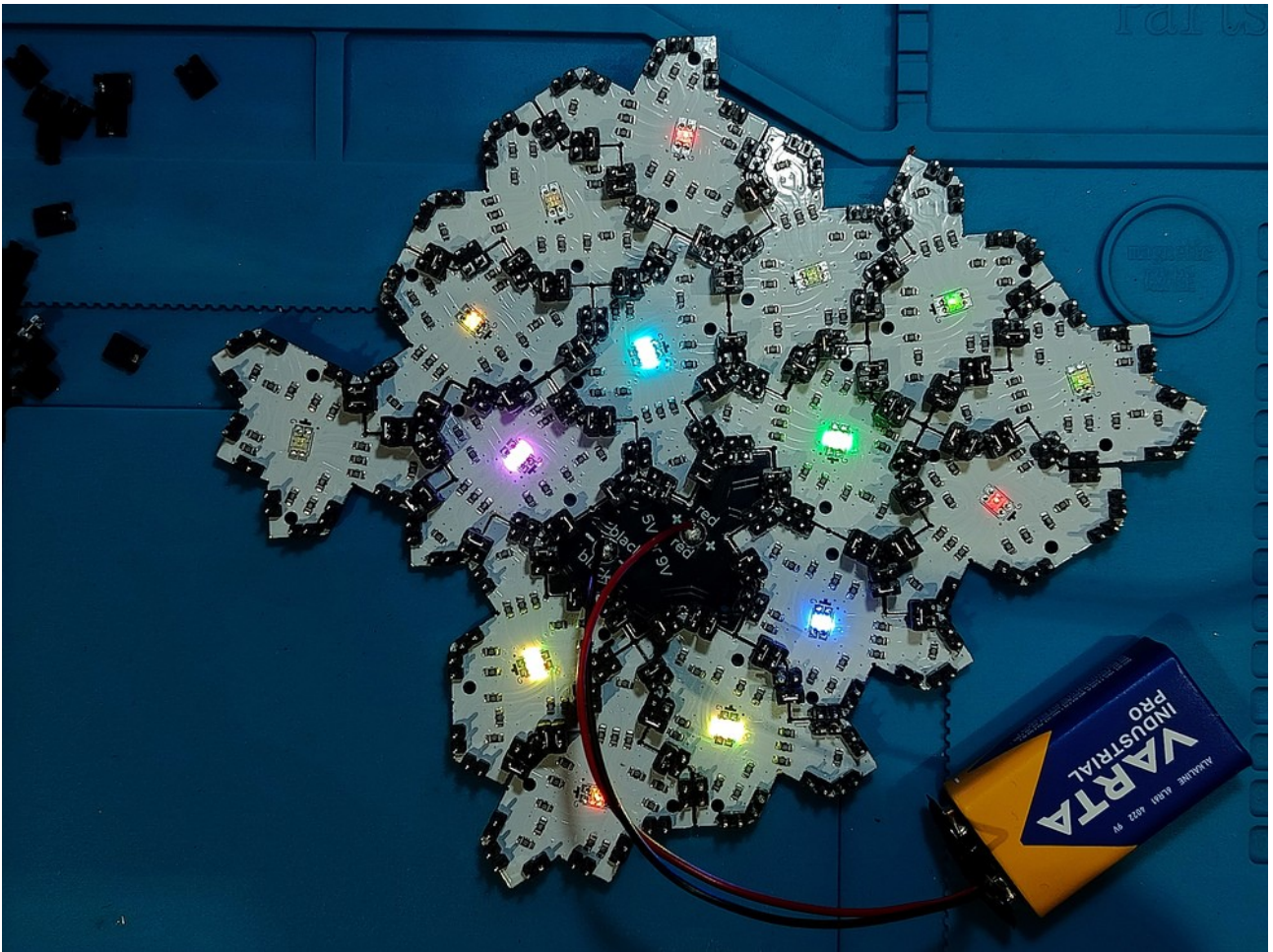
changing the puzzle also changes colors.

happy puzzling!



you can also buy an extension kit from us for the same price as the basic kit.

the extension kit contains 8 spectre tiles but not black power tile.



so you can create larger puzzles.

thanks for choosing the spectre kit from us!

please send questions, photos, and any kind of feedback to spectre@wenzellabs.de

you find other kits, infos and products under <https://wenzellabs.de/>

THANKS A LOT!