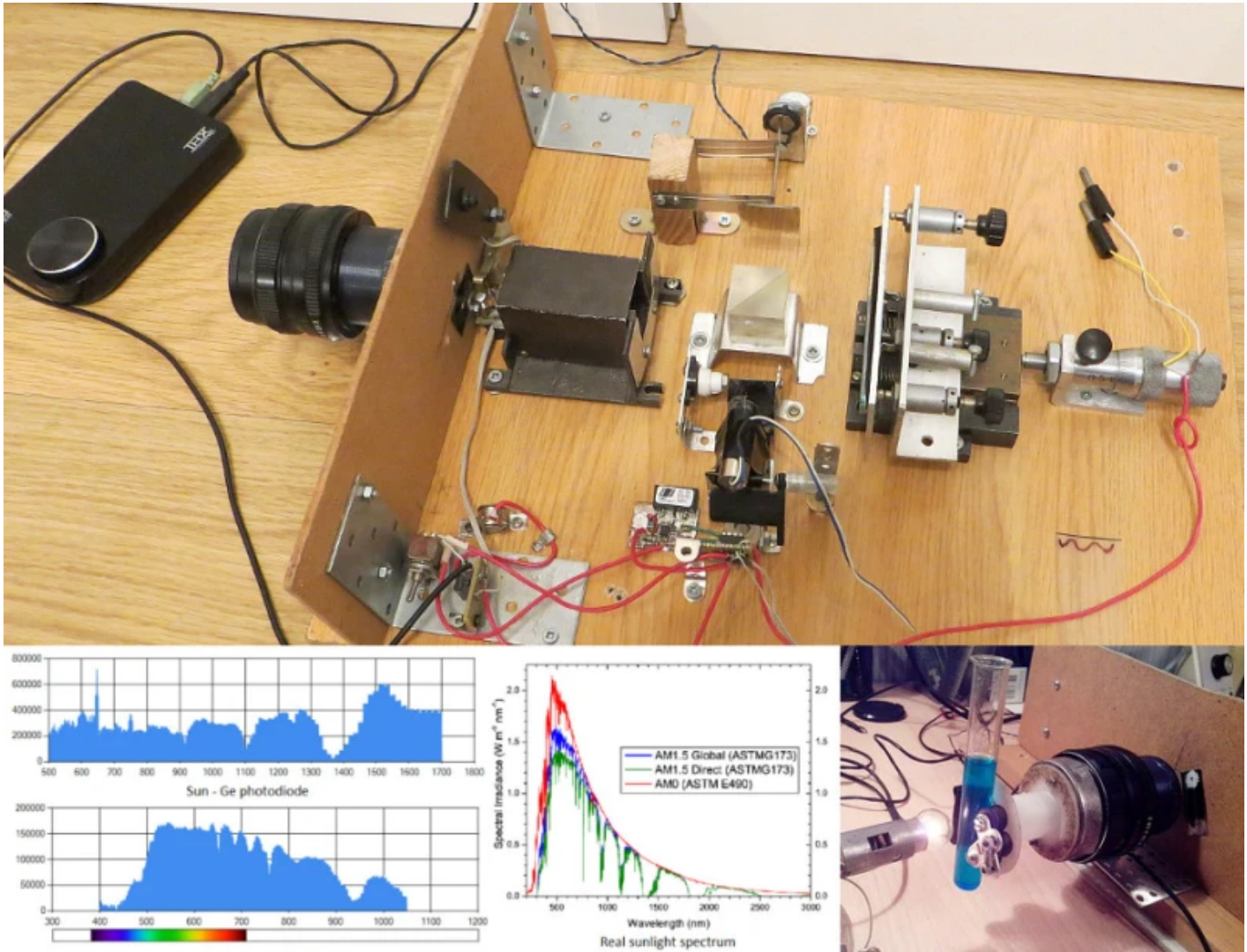


A DIY FOURIER TRANSFORM SPECTROMETER

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Typical spectrometers use prisms or diffraction gratings to spread light over a viewing window or digital sensor as a function of frequency. While both prisms and gratings work very well, there are a couple of downsides to each. Diffraction gratings produce good results for a wide range of wavelengths, but a very small diffraction grating is needed to get high-resolution data. Smaller gratings let much less light through, which limits the size of the grating. Prisms have their own set of issues, such as a limited wavelength range. To get around these issues, [iliasam] **built a Fourier transform spectrometer (translated)**, which operates on the principle of interference to capture high-resolution spectral data.

[iliasam]'s design is built with an assortment of parts including a camera lens, several mirrors, a micrometer, laser diode, and a bunch of mechanical odds and ends. The core of the design is a **Michelson interferometer** which splits and recombines the beam, forming an interference pattern. One mirror of the interferometer is movable, while the other is fixed. [iliasam]'s design uses a reference laser and photodiode as a baseline for his measurement, which also allows him to measure the position of the moving mirror. He has a second photodiode which measures the interference pattern of the actual sample that's being tested.

Despite its name, the Fourier transform spectrometer doesn't directly put out a FFT. Instead, the signal from both the reference and measurement photodiodes is passed into the sound card of a computer. [iliasam] wrote some software that processes the sampled data and, after quite a bit of math, spits out the spectrum. The software isn't as simple as you might think – it has to measure the reference signal and calculate the velocity of the mirror's oscillations, count the number of oscillations, frequency-correct the signal, and much more. After doing all this, his software calculates an interferogram, performs an inverse Fourier transform, and the spectrum is finally revealed. Check out [iliasam]'s writeup for all the theory and details behind his design.

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