Interferometry: The Real Story
(As told by the victims)

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Introduction:

In this paper we discuss the nature of Michelson and Fabry-Perot Interferometry and its application to spectroscopy. Our findings shed light on such diverse subjects as the yellow doublet of sodium, the desiccation of the human eyeball and uses of really big screwdrivers in physics experiments.

Theory:

The first interferometer was invented by Thomas Young in 1801 as a way to punish his research students. Since then its application as an instrument of torture has been perfected by such great minds as A.A. Michelson, Charles Fabry and Alfred Perot. These men discovered that if a student was failing to perform at the expected level, several weeks of interferometry could make them amazingly eager to devote themselves to any other form of work. Indeed, once exposed to interferometry, all it took was the mere mention of the word "fringes" or a casual reference to "parallel mirrors" to make the student agree to any assignment imaginable. The only side affects to this method of correction seemed to be blindness, headaches, and a somewhat persistent nervous twitch. This method of student coercion proved so successful that Michelson was awarded the Nobel Prize for his contribution to science in 1907.

The one difficulty in applying the interferometry method to students is that if the student suspects the true purpose of the exercise they may be less than eager to participate. This can be easily overcome if the research professor or lab instructor uses a reasonable amount of deviousness and duplicity. For example, if the lab instructor innocently places "Michelson and Fabry-Perot Interferometry" on his list of possible experiments and describes it as "straightforward" and "interesting" his students will unwittingly sign up to write lab reports on the subject.

Procedure:

In the classical style, my lab partner and I agreed to the interferometry lab without any understanding of its true nature. We naively believed that we were only studying the yellow doublet of sodium. The theory is simple. If light consisting of two closely spaced wavelengths is passed into the Fabry-Perot interferometer, two circular fringe patterns are supposed to be visible. By measuring the distance the mirrors must be moved in order to bring the fringes in and out of coincidence it is possible to calculate the spectral line separation of the sodium yellow doublet. The procedure described below was what we were instructed to do and what gave us our initial indications of the true nature of the exercise.

Step 1: Set up Fabry-Perot Interferometer. Place Unit N in line with the collector lens from Unit L and the mirror (properly inverted and rotated) from Unit A. Do not place the telescope in position. Focus eyepiece at infinity before inserting in upper slot of Unit H. (do not forget to rotate pointer!). Clean eyepiece reticule. Screw/bolt everything to everything else.

It was at this step that we had our first glimmer of suspicion. After a half dozen careful inspections of our equipment, it was discovered that the collector lens from Unit L and the reticule, in fact, did not exist. Instead there were several mysterious objects: two long

black tubes and various bits of aluminum with cracked glass that did not fit into any part of the apparatus, although we tried inserting them everywhere. (We even walked down the hallway holding these things to our eyes to see if we could "focus at infinity".) After several hours of effort we gave up and decided to find the fringes without the imaginary equipment. The results are shown in Fig. 1. (Do you see fringes?)

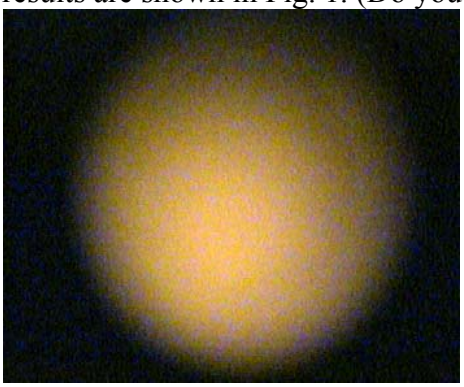

Fig.1. The distinct circular interference pattern of the Fabry-Perot.

Step 2: Have following dialogue with lab partner:
Student 1: I don't see any fringes. Do you?
Student 2: No. Adjust Unit N again.
Student 1: I still don't see any fringes…
Student 2: Here, I'll just turn this knob…

Continue on this line of discussion for approximately 120 minutes. Conclude with:

Student 1: I got it!!! If you just squint really hard and stand about three feet over there with your head on your knees and one foot in the air you can maybe….sort of… see some fringes!
Student 2: (Any sufficiently varied soliloquy of whimpering and disparaging comments on fringes and Student 1's mental competency will work here).

Step 3: To calibrate interferometer, turn micrometer bar until 200 fringes have passed through the field of view. As it turns out it is difficult (in the most terrible and painful sense of the word) to count 200 fringes. In order not to lose count it is imperative that the experimenter does not blink, move, or breathe for the approximately 40 minutes necessary to count 200 fringes.

Results:

After weeks of observation we discovered that a person's eyelids feel just like sandpaper if one counts fringes without blinking for several hours. (We also learned that interferometry has a powerful desiccating action on both the eyes and brain). We became quite adept at seeing in the dark, which initially seemed harmless until we tried to leave the lab. This stage of the interferometry punishment calls for the students to leave lab and walk across campus weeping steadily from the sunlight and bearing a distinct resemblance to bedraggled barn owls.

At last after many days of diligent work, interference patterns were visible. In order not to lose these precious apparitions, the entire interferometer was taped to the surface of the lab bench including mirrors, knobs, and the fingers of the experimenters. It is at this point having a really big (at least 1.5 ft.) screwdriver in the lab becomes necessary. The screwdriver can be employed to secure all screws in the vicinity and to menace anyone who attempts to breath in a 10 ft radius of the interferometer. (This threat is not to be taken lightly since interferometery causes a significant increase in aggression).

Conclusion:

We discovered the hidden intent of interferometry only by using careful scientific technique and inferring logical conclusions from our data. By analyzing the systematic discomfort and well-planned tedium we were subjected to, we could come to no other conclusions. We were dismayed to realize that the real goal of the experiment had been thoroughly achieved with us. By the end of our experiment we have become compliant, repentant students. In exchange for ceasing our interferometry we will gladly study any form of physics that does not require eyesight or the ability to count. However, we would recommend that no one mention the word “fringes” near us for some time. We still know where the really big screwdriver is….