CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

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Project Number

J0901

Project Title

Holograms: Timing Interference

Abstract

Objectives/Goals

The objective was to determine if changing the amount of time the holographic plate and object are exposed to the laser impacts the clarity of the holographic image.

Methods/Materials

Materials included 12 holographic plates containing an emulsion that was sensitive to laser light in the 625-650 nm range, a 3-4 mW diode laser with 3.0 volts, developing solution chemicals, bowl filled with coins used as object, a glass vase for a stand and a coffee cup filled with salt to minimize vibration, a physics books used as a shutter, a self-made scoring device, and an iPhone to record time. The setup included choosing a dark room, setting up a stable structure for stability, mixing the developing solution, and placing solution in bowls. Object was placed in position of the laser but blocked by the shutter. Lights were turned off, shutter was lifted and exposure time timed. 5, 12, 22, and 60 second exposure times were used. Three tests for each interval performed. Results were recorded and measured using the scoring device.

Results

No initial pattern was detected in all of the averages for the exposure time, except that the 12 seconds plates were the most consistent. The lowest score was an 8 by the 22 seconds plate and the highest was 21. The total possible points that a plate could score was 27, where each plate was divided up into 9 sections. The maximum a section could score was 3. The two highest plates were the 60 and 12 seconds plates. The 60 second plates were clear with a winning average of 15.3̅, while the 22 second plates were clear with an average of 15 points. The third highest was the five second plates with a mean clarity score of 11.6. In the 22 second tests, the images were blurry making 22 seconds the worst with an average of 9.67.

Conclusions/Discussion

The hypothesis was partially correct and partially incorrect. It was wrong because 60 second trial had the highest overall average clarity score. The hypothesis was right because changing the exposure time did impact the clarity results of the hologram, establishing a relationship between exposure times and clarity. If there was not a relationship, all the clarity averages for the different times would be the same. The problem was that a pattern of how these different times helped or made the hologram worse was not definitely detected.

Summary Statement

The experiment was to find out if changing the amount of time the holographic plate and object are exposed to the laser impacts the clarity of the holographic image.

Help Received

Emma's dad helped with the mixing of the more dangerous chemicals and finding some of the materials used in the experiment; Emma's mother helped with cutting the paper on board.