



电子科技大学  
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# Physical Experiments I

## Pre-lab Assignment

### Experiment Title

laser holography

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Date Performed: 26th March 2017



Score

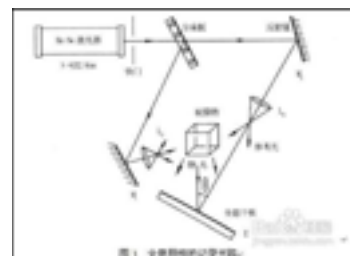
### Answers to Questions (20 points)

#### (1) What is coherence as applied to optics. State the required conditions for observing coherence pattern?

In general, the concept of optics coherence is that two beams of light, which have same vibration frequency and constant difference, generating the appearance of wave superposition.

Only when two waves maintaining in the same phase, optics coherence could happen. This implies that they have the same frequency, the phase is unchanged throughout time as well. Coherence can be classified into temporal coherence and spatial coherence roughly. Temporal coherence has closely connection with the line width of the wave. This phenomena will happened if we observing in the following condition:

- Interference light should have a certain power.
- We should use stable operating platform.
- Light path is stable.
- Light spot is uniformity
- Object light and reference light should coincide to the screen.
- Make sure to place each equipment in a suitable angle.
- The difference of optical path should close to zero.
- We should use high resolution holographic film during this experiment.



#### (2) In the double-slit experiment, what method was utilized to obtain two beams with the same frequency for coherence? In laser holography

**experiment, What method was used to obtain two beams in order to observe coherence pattern?**

During double-slit experiment, we use Wavefront Splitting, there are two narrow slits which aim to divide the same one beam into two beams, thus it cultivates different paths and could meet and produce interfere then.

In our laser holography experiment, The creation of these fringes begins at the He-Ne laser which is a radiation source. As soon as the light leaves the He-Ne laser, it will be split and directed by two separate paths. One path leads to the object, where the light scatters in all directions, in the form of circular wave. Then, it routs to a recording medium. The other path of beam illuminates onto the same recording medium directly. However, there is a little difference that the two beams have an altering angle and they leave the object in a virtually unchanged way in its platform.

**(3)What are the differences between normal photography and holography?**

Normal photography is based on the geometrical optics' refraction law. It only records the information from the object beam, point to point, with no stereo perception. And there is no much requirement to the light source. However, holography is a advanced technique that allows the coherent light to be recorded and later reconstructed even if it is scattered by the object. So when we see the photo which is taken by holography, we always feel that we are just looking the real object which we recorded. Remarkably, the image will change when the position and orientation of our viewing system changes. In this way, we could make sure the photo we take is the same as its real object.

**(4) Can laser used in holography be replaced by other light sources?**

**Why?**

The laser used in holography can be replaced by other light sources which meet the test requirements. Laser holography technology is based on optical interference, it requires that the light source must have good interference capability. We know that laser has good ability at space and time interference, so the beam can also be replaced by any other light source which has good interference capability.