Construct, Conduct & Comprehend Physics Experiments

LEOK-3-32 Study on Theta Modulation & Pseudo-Color Encoding

- *Complete set*
- *Cost effective solution*
- *Detailed instructional manual*
- *Easy alignment*

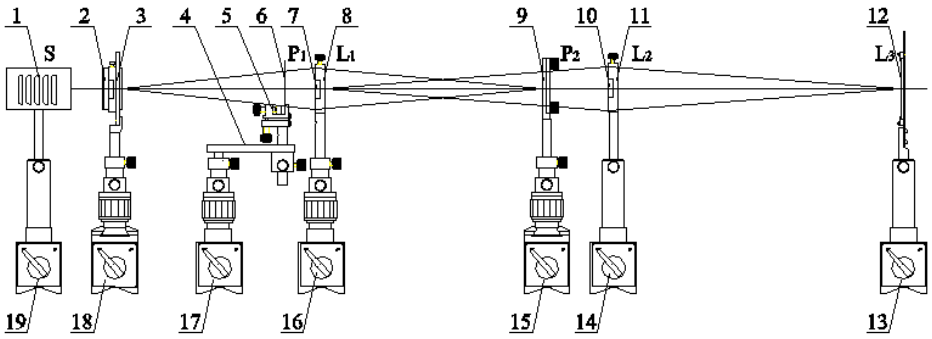


Figure 32-1 Schematic of experiment setup

1: Bromine Tungsten Lamp (LLC-3)
2: Rotary Lens Holder (SZ-06A)
3: Multi-Pinhole Plate (SZ-23A)
4: Extension Piece (SZ-09)
5: Plate Holder (SZ-12)
6: Theta (q) Modulation Plate P_1
7,10: Lens Holder (SZ-08)
8: Collimating Lens L_1 (f'=150 mm)
9: Paper Clip P_2 w/a piece of paper (SZ-50)
11: Fourier Transform Lens L_2 (f'=225 mm)
12: Ground Glass Screen P_3 (SZ-49)
13,14,19: Magnetic Base (SZ-04)
15,18: Two-Axis Stage (SZ-02)
16,17: Z-adjustable Stage (SZ-03)

Theory

Theta modulation is an application of Abbe's imaging, so the theory of theta modulation is almost the same as that of Abbe's imaging (refer to the principle in previous experiment). The object used is a special grating that is composed of three groups of grating reticles. The angle among them is 120° and they represent sky, wall and ground, respectively. Fourier spectrum of such a grating is shown in the middle of Figure 32-2.

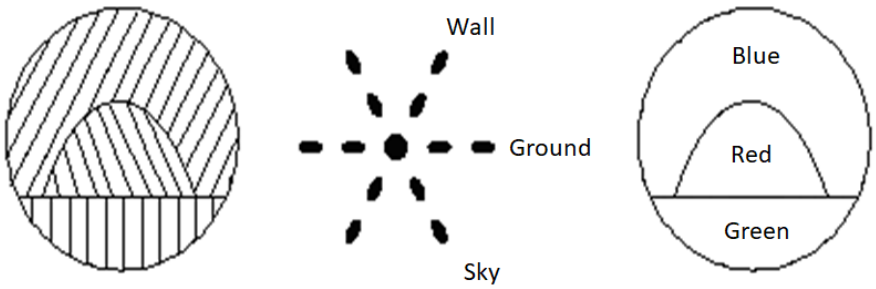


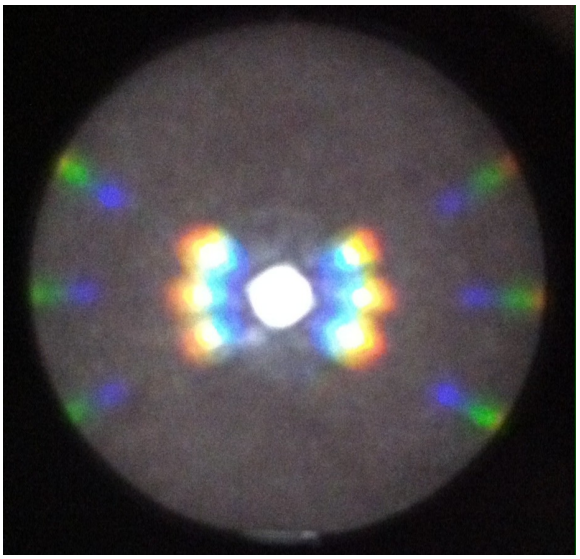
Figure 32-2 Schematic of Theta modulation plate

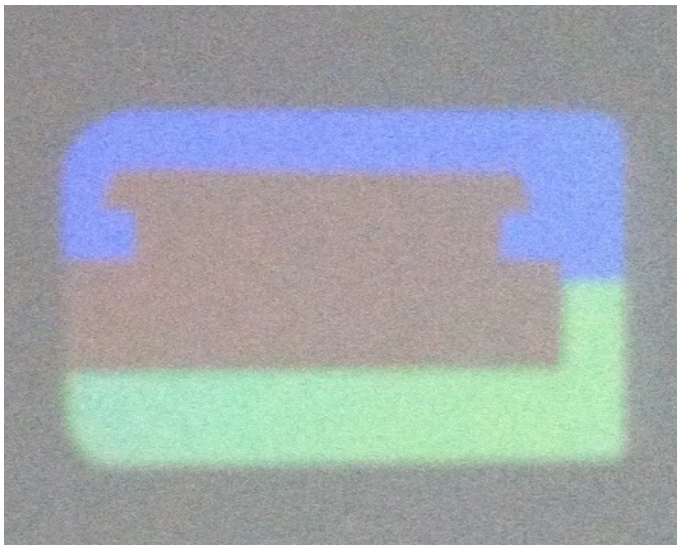
We can use the filter to select the spectrum we want. We can get 'blue sky', 'red wall' and 'green ground'. It is also called pseudo-color encoding.

Experiment Procedures

Note: This experiment example is recommended to be carried out in a less bright environment.

1. Place an aperture on the output window of the white light source (the 1.5 mm hole on the multi-pinhole plate can be used). Lens L_1 images the hole onto paper screen P_2 located at more than 0.6 m away from the lens (note, the height needs to be the same).
2. Place θ-plate P_1 (upside down) in front and close to lens L_1 (use extension piece SZ-09), remove the paper screen temporary. Shift lens L_2 to achieve a clear image of P_1 on ground glass screen P_3.
3. Bring back the paper screen, finely adjust related components, clear color diffraction spots can be observed on the paper screen (it is similar to the middle image shown in Figure 26-2, otherwise move the paper screen slightly to bring into focus);
4. Using a very sharp pin, pierce holes on the paper screen. Only use the first order spectrum (zero-th order will produce the entire image). As each hole is made, observe the associated image portion on the screen. Once the Fourier spectrum with each corresponding image portion is determined, replace the paper with a new one; (Note: this step is trying to determine the grating directions of the three areas on the θ-plate);
5. Using the pin more carefully now, pierce holes at the relevant places on the tiny spectra, i.e. filtering single colors through to observe the sky as blue, the wall as red and the ground as green (or your own selection of colors).





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