

Optical phenomena by the glass beads

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ABSTRACT

Glass beads show various optical phenomena. We studied optical phenomena by using 0.002mm to 1.40mm diameter glass beads. Soda-lime Glass Beads produce rainbows over a very wide range of sizes. However halos are observed in a narrow range of sizes. The author found reflexive beads make bows which spread when the beads become smaller.

1.METHOD OF THE EXPERIMENT

Beads of different sizes on a screen or a transparent film show us various optical phenomena when lit. The various size beads are screened by means of metal meshes of different sizes and checked with a microscope.



Fig.1 The experiment of rainbow beads

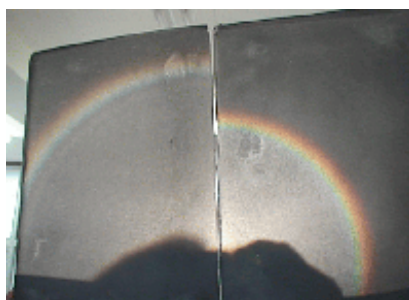


Fig.2 Different radii by the refractive indices



Fig.3 Microscopic view of glass beads

2. RAINBOW BEADS

The method of observing the rainbow with the transparent plastic beads is reported by Uchikawa, Hamasaki and Kunida in 1980. It is called, "Rainbow beads" in Japan, and is popular teaching material on the subject of light.

The left rainbow is made by the glass beads, and the right one is made by the plastic beads in Fig2. Their radii differ by their refractive indices.

We can observe the rainbow of the Soda-lime Glass Beads under very wide range of their

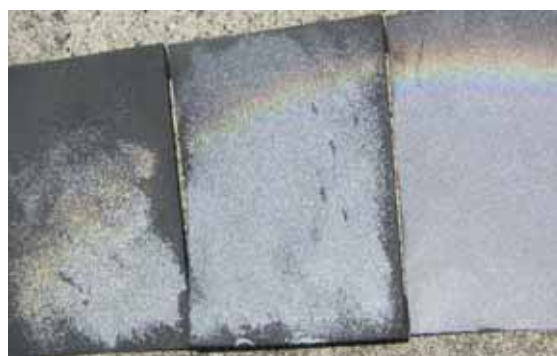


Fig4.The diameter is from left to right :0.71-1.00,0.50-0.71,0.21-0.30mm



Fig5.The diameter is from left to right :0.075-0.106,0.053-0.075,0.038-0.041mm

sizes, from 0.04mm to 1.0mm. We can observe a clear rainbow at 0.02-0.05mm diameter in case of glass beads.

3. Halo Beads

To observe a halo as Fig.6, we throw light from a point source over beads pasted on transparent sheet. The diameters of the halo beads range for 0.02mm to 0.1mm. Halo is produced by both transparent and opaque glass beads.



Fig.6 Halo by glass beads

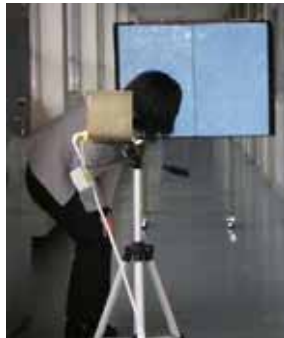


Fig.7 The method of observing

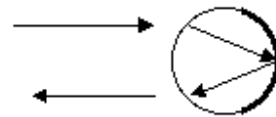


Fig.8 Principle of a reflexive bead

4 The Bow by Reflexive Beads

Barium-titanate glass beads (refractive indices are 1.92 -1.93) has it's focus point on the surface of beads as Fig.8. The author found that the bow spread as the beads become smaller as in Fig.9.



Fig.9 The diameter is from left to right :0.070-0.090,0.060-0.080,0.053-0.065,0.040-0.060,0.020-0.040mm

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