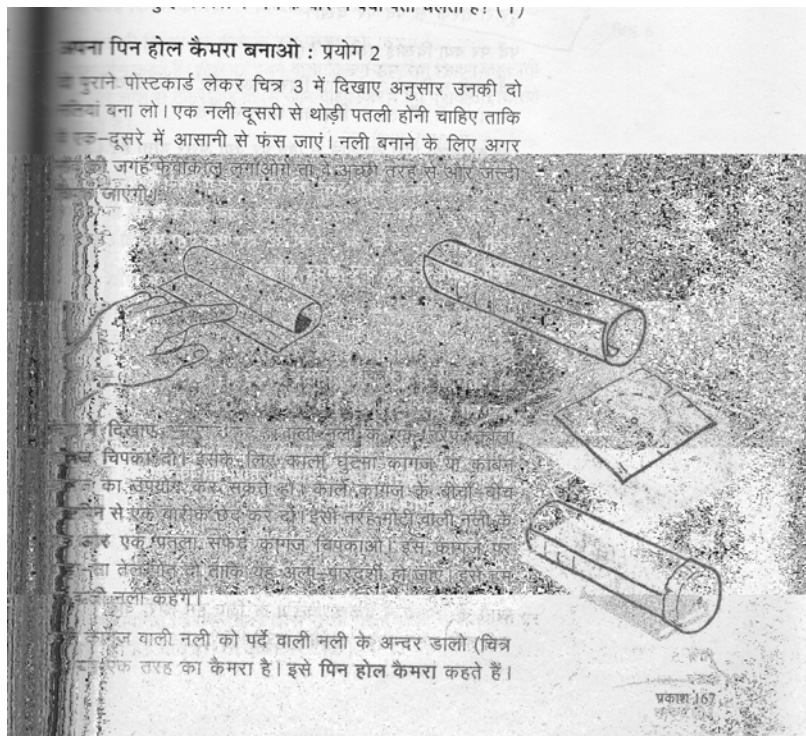


## The celestial objects and nature's pin hole camera



The other day in the school we told the students how to make a pin hole camera and then told them to make their own. There was a great enthusiasm, students collected material and made many models. Many had difficulties, most stumbled on making the 'pin hole'. They made it very big and then the image was not sharp. They could see the effect of size of hole on the sharpness and intensity but understanding why took needed a lot of discussion.

Drawing a series of diagrams like these I believe helped.

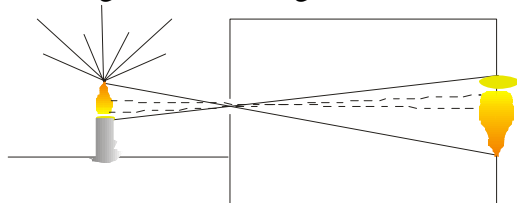


Fig A

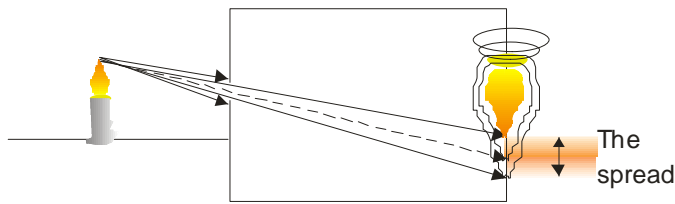


Fig B

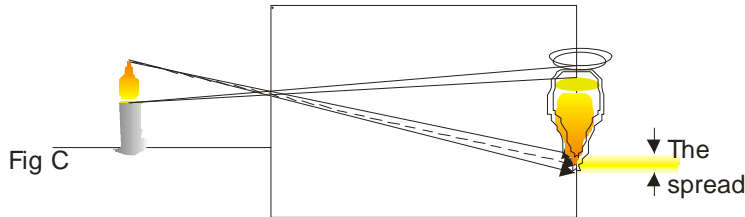
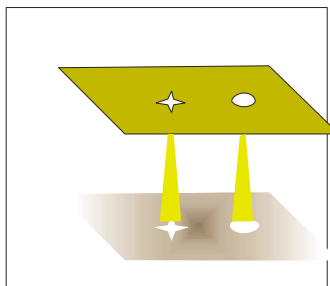


Fig C

To test their understanding we did two more experiments. The first experiment was done by punching two or three holes on a white paper. The holes were made of different shape – circle, triangle, star, etc



Hold the paper above ground about 1 feet away. We see the bright images of the holes of the shape of the holes. This was very much expected. Now slowly move the paper away from the ground. The images start becoming less sharp and when the paper is sufficiently away from the ground they become circular.

We asked students to explain why the images were circular even when the hole was of different shape.

We told the student that the pin hole camera you made just now hold a clue to the answer. But students could not get the connection. So I added another hint “..try thinking in this direction .. the punched hole in the sheet of paper, no matter what shape it is, will behave like a pin hole if the object is very very far. What is the object in this case?”

We did another experiment to see if that helps in solving the mystery .

We made three different shaped plane mirrors by sticking black tape on a mirror strip.. a square, triangle and rectangle.

First I held the mirror in such a manner that the sun’s rays reflected from the mirror would fall on a nearby wall. All children could see square or triangular image.

Next I readjusted my angle such that the reflection was now on a wall much further. .. and as if by magic all images were now circular.

By now some teachers had cracked the reason and were busy trying to explain the phenomenon. A huge discussion followed. The students were not at all sure that the images that they were seeing on the wall (or on ground as in the first experiment) were that of the sun. One compulsive evidence that the images were of the sun itself was that the image was independent of the shape of the hole. To demonstrate further that the image is always circular irrespective of the shape of the hole we looked at a tree the shadows and the light trickling through the gaps between the leaves.



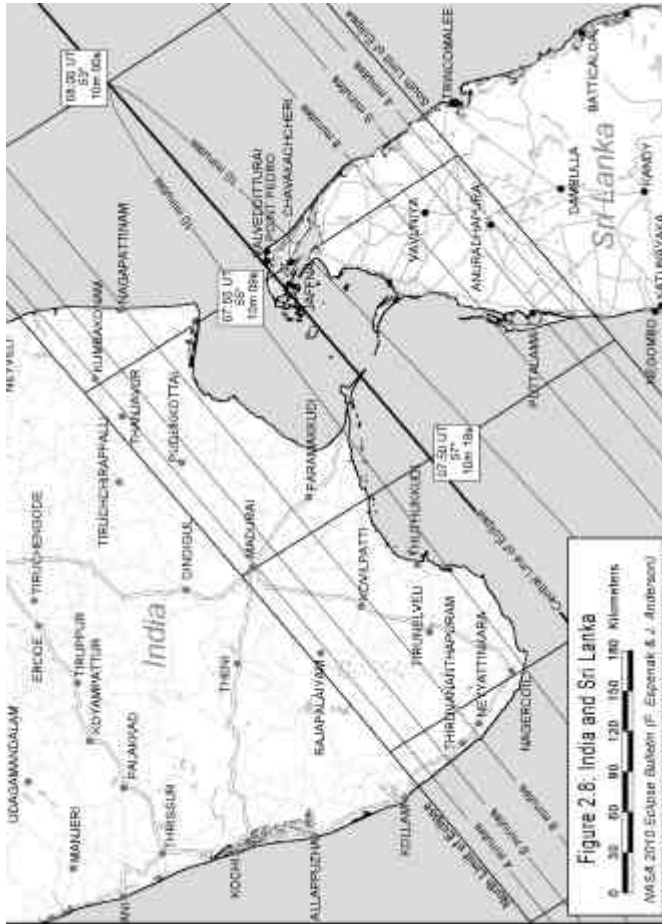
“ I wish I can change the shape of the Sun and make it square or something to really see if the circular images are only due to the Sun as you say” expressed a student.

Well we can not make the sun square but there is an opportunity when the shape of the sun changes.

During a solar eclipse when the moon comes in between the sun and the earth blocking the bright disk even partially will mean the sun is not circular during that time but will be a truncated disk. What will be the shape of the shadow at that time?

Fortunately I got an opportunity quite soon after the class.

On 15 Jan 2010 we witnessed an annular solar eclipse. The eclipse was visible as a partial eclipse in most of India but in a narrow strip at the southernmost end one could see this as annular.



I was fortunate to be able to be in that part of India and witness this great celestial phenomenon.  
 Here are some photographs of that time .. you can see for yourself the Nature's pin hole camera !!



Partial state 15 Jan 2010



Shadows during partial state 15 Jan 2010





Annular solar eclipse 15 Jan 2010 from Point Callimere TamilNadu.



Tree shadow during annular eclipse.