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| **Twinkling Stars**  *Trigger Activity* | | | | |
| **Stream:** Exp / N(A) |  | **Topic:** Light (Refraction) |  | **Estimated Duration:** 10 min |

This trigger can be used before the commencement of lessons on refraction of light. It allows students to observe a captivating phenomenon caused by refraction of light in air.

A laser is set up such that the beam passes over the top of a Bunsen burner and makes a spot on the wall. When the Bunsen burner is lit, the spot will be observed to “dance” around the original spot. When the flame is extinguished, the spot stops moving.

This dancing effect is caused by refraction of light in air. When the air above the Bunsen burner is heated, the refractive index of this layer of air decreases with respect to that of the surrounding air. This variation in refractive index causes the beam of light to refract or bend continuously and the spot on the wall to “twinkle”.

**Materials:**

Bunsen burner

Laser

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| **Description of activity** | **Pedagogical and Assessment Considerations** |
| 1. **Predict**   Hold the laser over the Bunsen burner and point out the projected spot on the wall to the students. Ask students to predict what will happen to the projected spot when the Bunsen burner is turned on.   1. **Observe** Light the Bunsen burner. The spot would be observed to “dance” around like a “twinkling star”. The teacher could swing the laser pointer to another wall away from the heated air to show a straight beam of light to contrast from the “twinkling” one. 2. **Explain**   Teacher gets students to hold a quick discussion to explain what they observed.  Some possible questions for students:   * What observations did you make about the position of the spot of light before and after the Bunsen flame was lit? * In terms of the path taken by the light rays, suggest why this difference was observed? * What did the Bunsen flame do to the surroundings to produce a change in the path taken by the light rays? | In lower secondary science, students have learnt about refraction of light. The common media used are usually glass or water to produce refraction. This demonstration extends that further to include air at different temperatures, and addresses a possible preconception that refraction only occurs in transparent solid (e.g. glass) or liquid (water).  Some possible conclusions at the end of the discussion are:   * The projected light is observed to “twinkle” as it is no longer travelling in a straight line. * This is because the heated air above the Bunsen burner has caused some “bending” or refraction of light. * A property of the air has been changed to result in this bending and this property is the refractive index of the air above the Bunsen burner.   Additional point of interest:  The twinkling of stars is explained by this phenomenon, stellar scintillation, where light from the stars alternate between reaching and not reaching where we are. The moon does not appear to twinkle because it appears larger and hence the effect is less noticeable. |

* **Recommendation for subsequent part of the lesson**

Please see lesson plan ***P4\_Refraction and Total Internal Reflection*** (http://subjects.opal.moe.edu.sg/sciences/secondary-science/physics)

* **Reference**

<http://sprott.physics.wisc.edu/wop.htm>