



# The White Glove Test

## **Lesson Summary**

In this lesson, students explore the SDC data interface to establish any trends in the dust distribution in the Solar System. Students record the number of dust particles, "hits," recorded by the instrument and the average mass of the particles in a given region.

## **Prior Knowledge and Skills**

- Knowledge of Astronomical Units (AU's)
- Scientific notation

## **AAAS Science Benchmarks**

### **The Physical Setting**

*The Universe*

## **NSES Science Standards**

### **Science and Technology**

*Understandings about science and technology*

### **Earth and Space Science**

*Origin and evolution of the Earth system*

**Teaching Time:** 1 50-minute period

## **Materials**

Access to the Internet

## **Advanced Planning**

**Preparation Time:** ~10 minutes

Familiarize yourself with the SDC New Horizons website at

<http://lasp.colorado.edu/sdc>

# The White Glove Test

## Discovering Dust in the Solar System: Educator Guide

In this activity, students use the Student Dust Counter data interface to determine the dust concentration at several different locations in the solar system. In this version, we suggest six different segments of New Horizon's path. As New Horizons continues in its journey, this activity will be supplemented with additional path suggestions.

### Skills used

Accessing and interpreting data

Presenting results to peers

Quantitative analysis

### Procedure

- Break the class up into small groups (4 or 5 students per group, for a maximum of 6 groups).
- Point each group to the SDC web site, <http://lasp.colorado.edu/sdc>. You may wish to let them spend some time perusing the site before beginning the data activity.
- Distribute the “White Glove Test” student worksheets and ask the groups to complete Parts I - IV. The prompts have been kept deliberately open-ended to encourage independent exploration of the data.
  - Part I: Here students analyze the number of hits recorded by the SDC. They may find that the SDC encountered a uniform distribution of dust during its journey, that the dust concentration trended in a particular direction (e.g. denser closer to the sun), or that the instrument found unusually dense (or vacant) pockets of dust.
  - Part II: Here students consider the mass of dust particles hitting the SDC detectors. They review the data looking for the same kind of trends they observed in Part I.
  - Part III: Now, students are asked to sketch the solar system and annotate the sketch with information about their observations from Parts I and II. Encourage students to consider how their results might be related to the “geography” of the solar system—distance from the Sun, proximity to planets, etc.

After about 20 minutes, bring the groups together and have them share their results. You may wish to record their results on the board. As a class, answer the questions posed in Part V.

Name \_\_\_\_\_

Date \_\_\_\_\_

## The White Glove Test

### Discovering Dust in the Solar System: Student Worksheet

For this activity, you will need to go to the Student Dust Counter web site:

<http://lasp.colorado.edu/sdc/>

With your group, read over the information on this page. Then use the table below to find the distance range that your group will be analyzing.

*What is an AU? An “astronomical unit” is a unit of distance equal to the average distance between the Earth and the Sun--about 93 million miles. For comparison, Jupiter is about 5 AU from the Sun, and Pluto averages a distance of about 40 AU.*

Group Number	Distance range
1	1 - 1.5 AU
2	1.5 - 2.0 AU
3	2.0 AU - 2.5 AU
4	2.5 AU - 3.5 AU
5	3.5 AU - 4.5 AU
6	4.5 AU - 5.0 AU

Circle or highlight your group’s distance range on the table. Now find the “Low AU” and “High AU” boxes on the data interface and enter your group’s data values.

#### Part I: Decoding Hits

On the left side of the interface, you will find four buttons. Click the “# of Hits” button to display the number of dust events recorded by the SDC at each step along its journey.

Total number of hits between \_\_\_\_ and \_\_\_\_ AU: \_\_\_\_\_

In the space below, describe the distribution of hits. Did the SDC record significantly more dust in one area than it did in another? Or, do you find that the dust is evenly distributed throughout the area?

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**Part II: Hit Mass**

Now click the “Hit Mass” button on the left side of the screen. The data display will change to show the average mass of the impacting dust recorded over each step of the SDC’s trip. As you did in Part I, use the display to find the following information about dust mass.

Total dust mass between \_\_\_\_\_ and \_\_\_\_\_ AU: \_\_\_\_\_

Do you see any correlation between dust mass and distance from the sun? Describe your results.

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### Part III: Geography of the Solar System

Now click the “Geography” button to bring up a map of the solar system. Note that the maximum range the data windows can display is 1.75 AU, so you will need to scroll to view the entire geography. In the area below, sketch the portion of the solar system between 1 AU and 5 AU.

Now, label your sketch to reflect the observations you made in Parts I and II.

You might note:

- Areas experiencing a very high or low number of dust hits
- Any directional trend relating to dust mass

### Part IV: Local Conclusions

Referring to your sketch from Part III, can you draw any conclusions about where in the solar system you are likely to find a high concentration of dust? Do you see a correlation between the number of dust hits recorded and the mass of those hits? Why do you think this is the case?

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**Part V: Global Conclusions**

Compare your results with those of the other groups. As a class, identify trends in the dust concentration and dust mass. How do they change with distance from the Sun? Is there any correlation between these two quantities?

Now try to answer the questions from Part IV again. Are your conclusions the same?

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