

Ice Hunters Lab

Introduction

In this lab, you will use the Ice Hunters project website to try your hand at locating Kuiper Belt Objects in real data. This is one of several currently available “citizen science” projects, where ordinary citizens can access real astronomical data and help to do real cutting-edge science. This project uses images taken by two world class telescopes, one in the northern and one in the southern hemisphere, to search for Kuiper Belt Objects. The goal of this project is to create a catalog of such objects, and to identify potential targets for the extended New Horizons mission (you’ll read more about this later). It is very likely that the objects you are finding are brand new heretofore undiscovered Kuiper Belt Objects. The images are not always pretty, but hey – this is real science!!

Materials

Computer, calculator, ruler.

Preliminaries

Create a Zooniverse account at www.zooniverse.org/signup.

Go to www.icehunters.org and sign in with your new account.

Background

Click on “the Mission” and read the information found there **in its entirety, then** answer the following questions.

1. What is the primary mission of the New Horizon spacecraft?
2. How long (in total from launch to arrival) will the spacecraft take to get to its primary target and how long will the encounter take?
3. Using your answer above, what percentage of the spacecraft’s total mission lifetime will be spent actually doing the science it was made for (vs. in transit)?

Finding KBOs

Click on “Tutorial” in the upper right menu bar.

Play the introductory video and watch it.

Read through the steps and study the images carefully. They tell you how to spot AND how to mark the different types of objects you might see. DO NOT MOVE ON FROM THIS PAGE until you understand the differences thoroughly. Note in particular that MOST images will have two or fewer “blobs” (potential KBOs). In fact, some will have no visible blobs and some images might be too low in quality to assess. Your job as an “ice hunter” will be to CAREFULLY assess each image, identify potential KBOs, asteroids, and cosmic rays and to rate the image quality before moving on. DO NOT RUSH THROUGH THIS PORTION.

Now it’s time to try your hand at identifying KBOs! To prepare to collect your data, read the following instructions BEFORE YOU START.

- (1) Tear off the back sheet of this lab, which shows some examples of the “Image Quality” designations. Keep this handy as you do your classifications.
- (2) ALL group members will need to examine EACH image and discuss what to mark. Arrange your seats so that ALL OF YOU can see the screen well. You should also alternate the group member who does the selecting every five to ten images, so that everyone gets a chance.
- (3) On each image, mark the potential KBOs (round, white circles) with the “mark blobs” tool.
- (4) On each image, mark the streaks (asteroid or cosmic ray) with the “mark streaks” tool.
- (5) Choose at least one image quality designation for each image
- (6) Keep in mind that some images will not have any blobs or streaks and some will have several. TAKE THE TIME (at least ten seconds) TO LOOK CAREFULLY AT EACH IMAGE before moving on.
- (7) Before moving on to the next image, record the number of blobs, the number of streaks and the image quality designation or designations that you chose in the table.

Now you’re ready to get started. Click on “Do More Science” on the lefthand side of the page. In total, you will need to look at 50 of these images. Again, do not rush. Be slow and methodical, take turns manning the mouse, and carefully record what you find before moving on from each image.

Image Number	# of blobs	# of streaks	Image Quality
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Image Number	# of blobs	# of streaks	Image Quality
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Image Number	# of blobs	# of streaks	Image Quality
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

Tally up the number of images that fulfill the following criteria and fill them in in the table below

Images with 0 potential KBOs	
Images with 1 potential KBO	
Images with 2 potential KBOs	
Images with 3 potential KBOs	
Images with 4 potential KBOs	
Images with 5 or more potential KBOs	
Total images with streaks	
Images with streaks that appear to be cosmic rays	
Images with streaks that appear to be asteroids	
Images that fall into excellent, some residuals, or good away from star categories	
Images that fall into any of the other categories	

Within your images that have apparent asteroids in them, what is the range in and average length of the asteroid streaks?

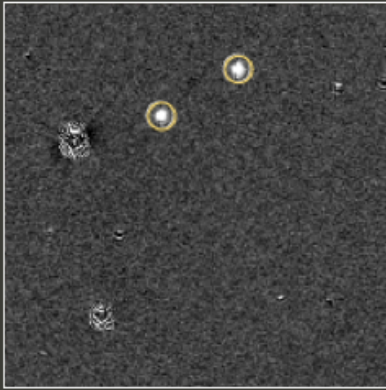
Range:

Average:

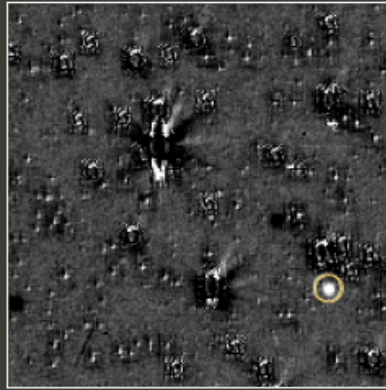
Why didn't all of the asteroids leave the same length streak?

In one page (below) summarize your results in words using percentages derived from the tallies in your summary table. THINK FOR A MINUTE before you begin writing about how to tie in all of the things that you tallied in the summary table. Present the whole story of what you discovered in a coherent way.

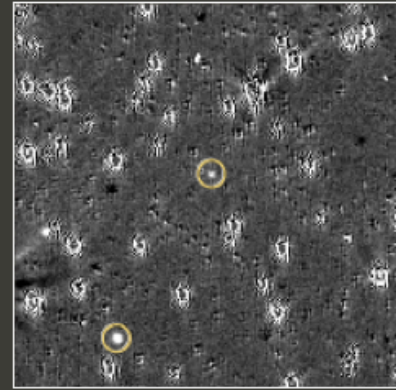
Excellent - A perfect image!



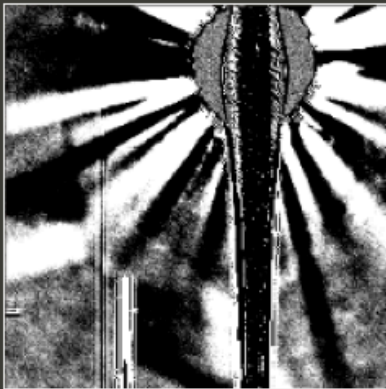
Some residual stars



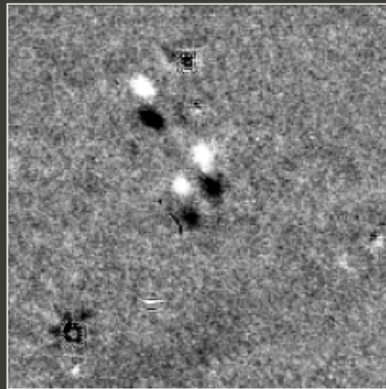
Good away from stars, but slightly washed out



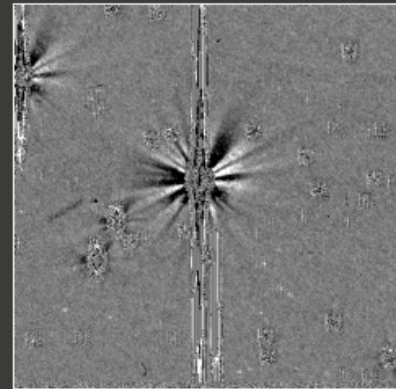
A very bright star is messing things up - hard to find anything



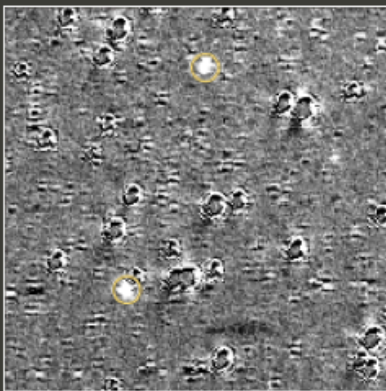
There are lots of black and white pairs aligned



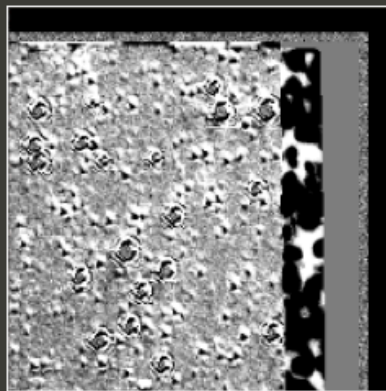
Blotchy background



Confusing stuff spread over image



Terrible subtraction



Simply terrible image

