How many stars are there?

On a clear night in the city you might be able to see a few hundred stars. In the country, far away from city lights, perhaps 5000 can be seen. Telescopes can see literally millions of stars. But how do we accurately count them? This exercise will show you the basic method!

This image was taken by the 2MASS sky survey. It is a field that measures 9.0 arcminutes on a side.

Problem 1 – By using a millimeter ruler, divide this star field into an equally-spaced grid that is 3 x 3 cells.

Problem 2 – Select 3 of these cells and count the number of star images you can see in each cell. Calculate the average number of stars in a cell.

Problem 3 – A square degree measures 60 arcminutes x 60 arcminutes in area. The full sky has an area of 41,253 square degrees. What are the total number of stars in A) one square degree of the sky; B) the number of stars in the entire sky.

Problem 4 – Why do you think we needed to average the numbers in Problem 2?

Answer Key

Problem 1 – By using a millimeter ruler, divide this star field into an equally-spaced grid that is 3 x 3 cells. Answer: An example is shown below.

Problem 2 – Select 3 of these cells and count the number of star images you can see in each cell. Calculate the average number of stars in a cell. Answer: Using the cells in the top row you may get: 159, 154 and 168. The average is 481/3 = 160 stars.

Problem 3 – Use the information in the text to convert your answer into the total number of stars in one square degree of the sky.

Answer: A) The answer from 3 is the number of stars in one cell. The area of that cell is 3 x 3 = 9 square arcminutes. One degree contains 60 arcminutes, so a square degree contains 60 x 60 = 3600 square arcminutes. Your estimated number of stars in one square degree is then 3600/9 = 40 times the number of stars you counted in one average one cell. For the answer to Problem 2, the number in a square degree would be 160 X 40 = 6,400 stars.

B) The text says that there are 41,253 square degrees in the full sky, so from your answer to Problem 3, you can convert this into the total number of stars in the sky by multiplying the answer by 41,253 to get 6,400 x 41,253 = 264,000,000 stars!

Problem 4 – Why do you think we needed to average the numbers in Problem 2? Answer: Because stars are not evenly spread across the sky, so you need to figure out the average number of stars.