The sun is our nearest star. From Earth we can see its surface in great detail. The images below were taken with the 1-meter Swedish Vacuum Telescope on the island of La Palma, by astronomers at the Royal Swedish Academy of Sciences (http://www.astro.su.se/groups/solar/solar.html). The image to the right is a view of sunspots on July 15, 2002. The enlarged view to the left shows never-before seen details near the edge of the largest spot. Use a millimeter ruler, and the fact that the dimensions of the left image are 19,300 km x 29,500 km, to determine the scale of the photograph, and then answer the questions. See the arrows below to identify the various solar features mentioned in the questions.

**Question 1** - What is the scale of the image in km/mm?

**Question 2** – What is the smallest feature you can see in the image?

**Question 3** – What is the average size of a Solar Granulation region?

**Question 4** – How long and wide are the Dark Filaments?

**Question 5** – How large are the Bright Spots?

**Question 6** – Draw a circle centered on this picture that is the size of Earth (radius = 6,378 km). How big are the features you measured compared to familiar Earth features?

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**Granulation Boundary**

**Solar Granulation**

**Dark Filament**

**Bright Spot**

Space Math  http://spacemath.gsfc.nasa.gov
**Question 1** - What is the scale of the image in km/mm? **Answer:** the image is about 108mm x 164mm so the scale is 19300/108 = 179 km/mm.

**Question 2** – What is the smallest feature you can see in the image? **Answer:** Students should be able to find features, such as the Granulation Boundaries, that are only 0.5 mm across, or 0.5 x 179 = 90 km across.

**Question 3** – What is the average size of a Solar Granulation region? **Answer:** Students should measure several of the granulation regions. They are easier to see if you hold the image at arms length. Typical sizes are about 5 mm so that 5 x 179 is about 900 km across.

**Question 4** – How long and wide are the Dark Filaments? **Answer:** Students should average together several measurements. Typical dimensions will be about 20mm x 2mm or 3,600 km long and about 360 km wide.

**Question 5** – How large are the Bright Spots? **Answer:** Students should average several measurements and obtain values near 1 mm, for a size of about 180 km across.

**Question 6** – Draw a circle centered on this picture that is the size of Earth (radius = 6,378 km). How big are the features you measured compared to familiar Earth features? **Answer:** See below.

![Granulation Region](image1.png) – Size of a large US state.

![Bright Spot](image2.png) – Size of a small US state or Hawaii

![Filament](image3.png) – As long as the USA, and as narrow as Baja California or Florida.