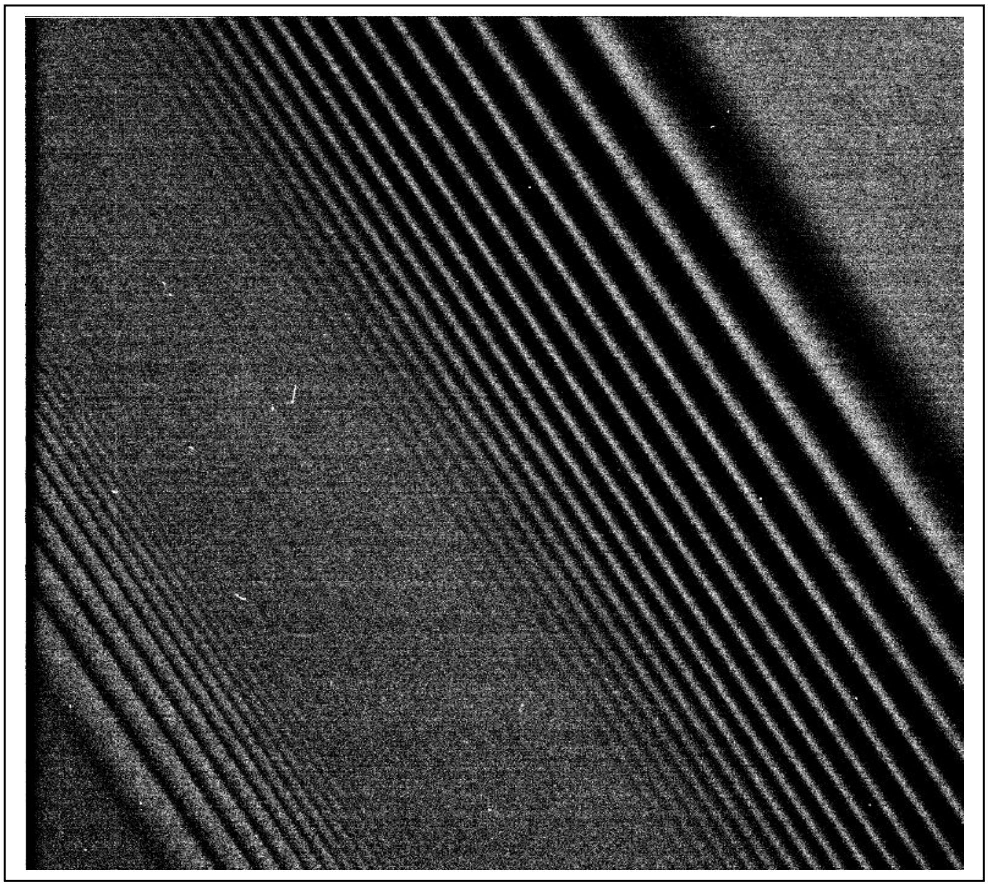
Saturn's Rings – A close-up study



This spectacular close-up image of Saturn's A ring was taken in 2004 by the Cassini spacecraft. It shows a 220-km wide snapshot of a magnified portion of the A ring, and how it dissolves into smaller ringlets. Astronomers think that these ringlets are formed by gravitational interactions with Saturn's inner moons, causing ripples and waves to form that 'bunch up' billions of ring particles into separate ringlets. Some of the bright spots you see in the dark bands may be 'shepherding moonlets' only a few kilometers in size, which keep the ring particles orbiting together.

Problem 1 – By using a millimeter ruler, determine the scale of this image in kilometers/millimeter, and estimate the width of a typical ringlet in this image.

Problem 2 – Draw a diagonal line from the upper right corner (closest to Saturn) to the lower left corner (farthest from Saturn). Number the 16 ringlets in consecutive order starting from the first complete ringlet in the upper right corner. In a table, state the width of each consecutive ringlet in millimeters and kilometers.

Problem 3 – What is the average width of the 16 ringlets you measured to the nearest kilometer?

Problem 4 – Plot the ringlet number and the ringlet width in kilometers. What can you say about the ringlet sizes in this portion of the A ring?

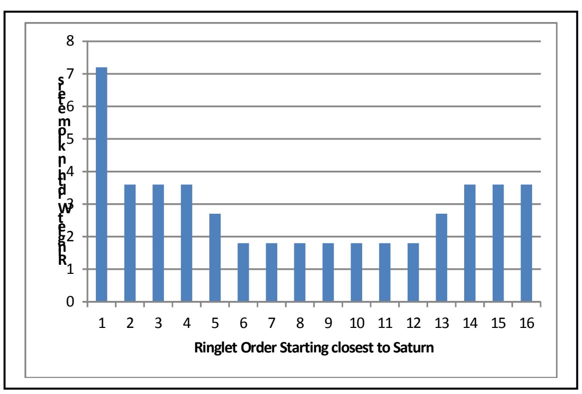
Problem 1 – By using a millimeter ruler, determine the scale of this image in kilometers/millimeter, and estimate the width of a typical ringlet in this image. Answer: When printed on standard 8 ½ x 11 paper, the width of the image is 124 millimeters, so the scale is 220 km/124mm = **1.8 km/mm**.

Problem 2 – Draw a diagonal line from the upper right corner (closest to Saturn) to the lower left corner (farthest from Saturn). Number the 16 ringlets in consecutive order starting from the first complete ringlet in the upper right corner. In a table, state the width of each consecutive ringlet in millimeters and kilometers. Answer: **See below**.

Ringlet	millimeters	kilometers
1	4	7.2
2	2	3.6
3	2	3.6
4	2	3.6
5	1.5	2.7
6	1	1.8
7	1	1.8
8	1	1.8
9	1	1.8
10	1	1.8
11	1	1.8
12	1	1.8
13	1.5	2.7
14	2	3.6
15	2	3.6
16	2	3.6

Problem 3 – What is the average width of the 16 ringlets you measured to the nearest kilometer? Answer: (6x3.6 + 7.2 +2x2.7+7x1.8)/16 = **2.9 kilometers**.

Problem 4 – Plot the ringlet number and the ringlet width in kilometers. What can you say about the ringlet sizes in this portion of the A ring?



Answer: The ringlet widths decrease as you get further from Saturn and are present with distinct dark gaps in between. As the dark gaps become narrower than about 3 km near Ringlet 12, the rings begin to increase slightly in size.

It is 'interesting' that the ringlets in the lower right corner are wider than the upper ringlets, and there are fewer of them.