

# Webb hyperbola

(July 2022)

The new Webb telescope having cost each household in America an average \$100, it is understandable that the government entities responsible for the expenditure should grab any opportunity to justify it in the eye of the taxpayer.

The first picture was presented to the press yesterday. The President made an impassioned speech.

The picture is centered on a cluster of galaxies which is referenced as *SMACS J0723.3-7327*. Its distance from us is estimated to be about 4.6 billion light-years. One representative for the project remarked that the width of the picture was like a tiny grain of sand held at arm's length.

That would be about  $1/3,000$  of a radian, or about 70 arc-seconds. The cluster being 4.6 billion light-years away, the width of the image is therefore about 1,500,000 light-years. As a yardstick, our Sun is 0.000015 light-year away from Earth, and the star closest to Sun is distant about 4 light-years.

The picture which was presented can be downloaded from the internet. Its resolution is 4,357 pixels across, which would indicate that each pixel has an angular width of 0.015 arc-seconds.

However, the maximum theoretical optical resolution of the telescope happens to be rather 0.1 arc-second, so it appears that the maximum width of the pictures cannot be greater than 667 pixels, each being 2,300 light-years across.

The first picture below is the original, 4,357 pixels across. The second was resampled at 667. It appears that the two pictures look quite similar, despite the serious theoretical loss of resolution, which is as high as 550%.

The colors in the picture are of course not natural colors, and the presenter did not explain which kind of graphic manipulation had been applied.

However, an interesting object resides at the very top left of the picture. By comparison with the size of the picture, it happens to be about the same size as our own Galaxy, which we call the Milky Way. A zoom on the object is provided at the bottom of this document.

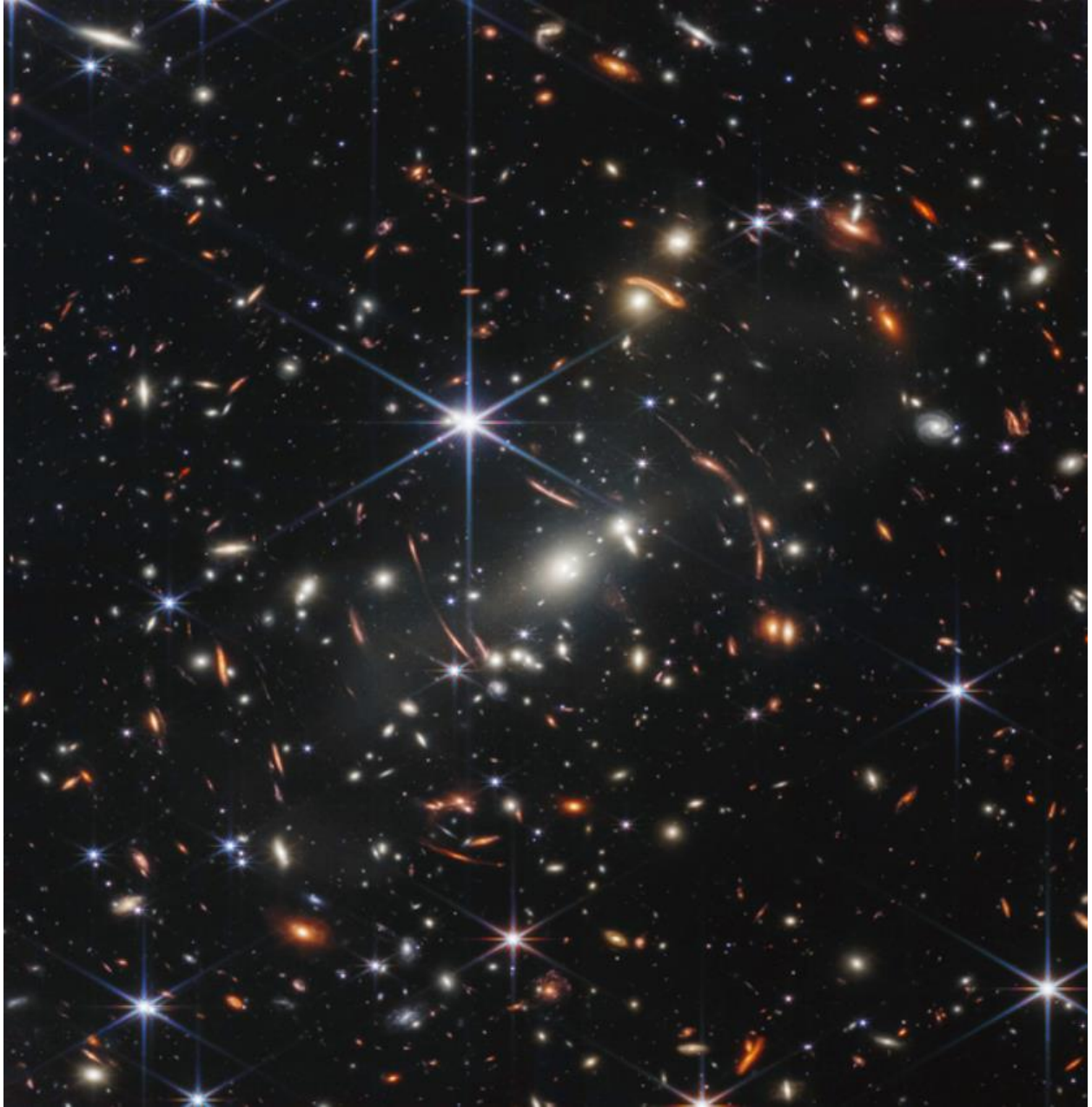
The width of the galaxy-looking object is about 45 pixels, while the approximate number of pixels covering the object is 500. When considering that the diameter of our own galaxy is of the order of 100,000 light-years and that there are in excess of 100 billion stars therein, it can be inferred that each uniform undifferentiated pixel contains as many as 200 million stars alike our own Sun, without providing any further detail, the width of each pixel being about 75 million Earth orbits around the Sun.

Some may be impressed, although not necessarily by some actual technical prowess.

The 4,357 pixels wide picture provided on the internet:



The same picture, resampled at 667 pixels across:



Zoom on the top left galaxy-like object:

