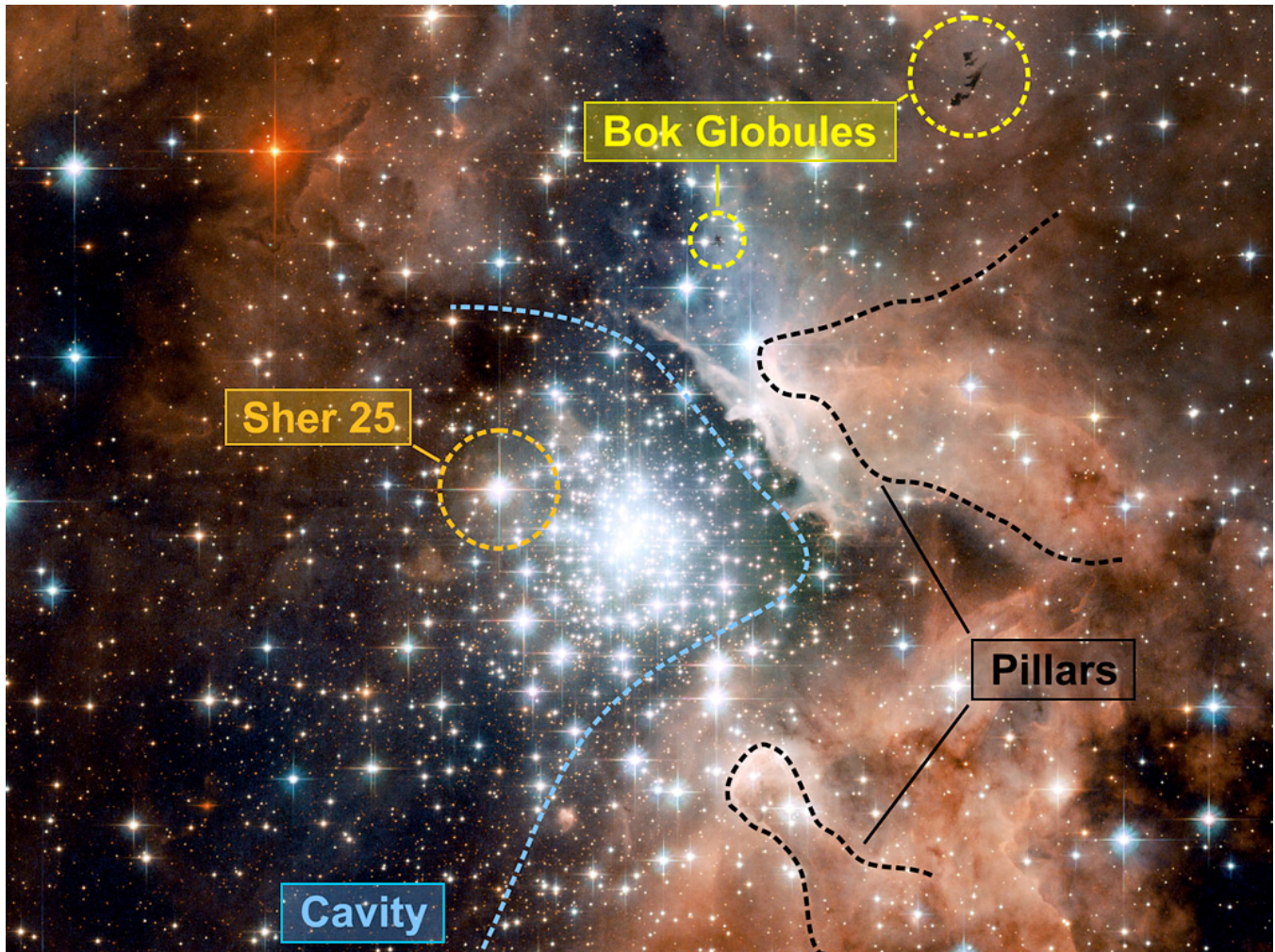


Plate 5: Star Nurseries



The Milky Way galaxy has been in existence for roughly 12 billion years, but it still contains huge clouds of gas and dust, equal to approximately 10% of its total mass. One might well ask the question, why is this gas taking so long to collapse? Why wasn't it turned into stars long ago?

The short answer is, gravitational gas collapse is a lot trickier than it appears. The marvelous photograph above, taken by the Hubble Space Telescope, shows a part of the nebula (fancy word for space cloud) known as NGC 3603. The center of the photo is dominated by a glittering cluster of sparkling new, hot, blue-white stars, most of which are probably less than 10 million years old. Their combined heat has completely evaporated the gas in their vicinity, creating a cavity in the nebula as indicated by the blue dotted line. Their light output is so great that gas outside the cavity is literally being blown away by it, as shown by the orangeish-colored shock fronts and gas "pillars" at the right. Even beyond this, the very young star known as Sher 25 is a stupendous blue giant that is roughly 300,000 times more luminous than the Sun and simply too large and too unstable to last long. It will likely explode spectacularly within the next few thousand years, and the blast wave will enlarge the cavity even more.

Bottom line: it is all but impossible for a gas cloud to just collapse into a cluster of stars with 100% efficiency. Instead, part of the cloud collapses, then hot new bright stars disrupt the gas that hasn't yet

collapsed, then the gas is blown back into the galactic darkness to await its next chance at star formation. Some of the gas in nebula NGC 3603 has probably flowed into a star-forming region and back out again half-a-dozen times already in the lifetime of the galaxy.

At the top of the photo there are some quite small, very dark regions called Bok Globules. These are in fact dense clouds of gas and dust that are very nearly at the point of becoming stars. Deep inside the clouds the beginnings of stellar birth are well underway, as the infalling gas has created a glowing, red-hot proto-star possibly the size of our solar system. It has only a few million years left to go before it becomes small enough and hot enough to ignite hydrogen fusion. After it does so, it is more than possible that some of the gas and dust around it will continue to collapse, but now into planets and comets orbiting the star.

As NGC 3603 demonstrates, star-forming regions are complex and beautiful. They do not collapse quickly or simply. There aren't nearly as many of them around now as there were six billion years ago, when the star formation rate was about five times its present value, but there are more than enough to show us a few of Nature's secrets – such as how the Sun and the Earth were once created.