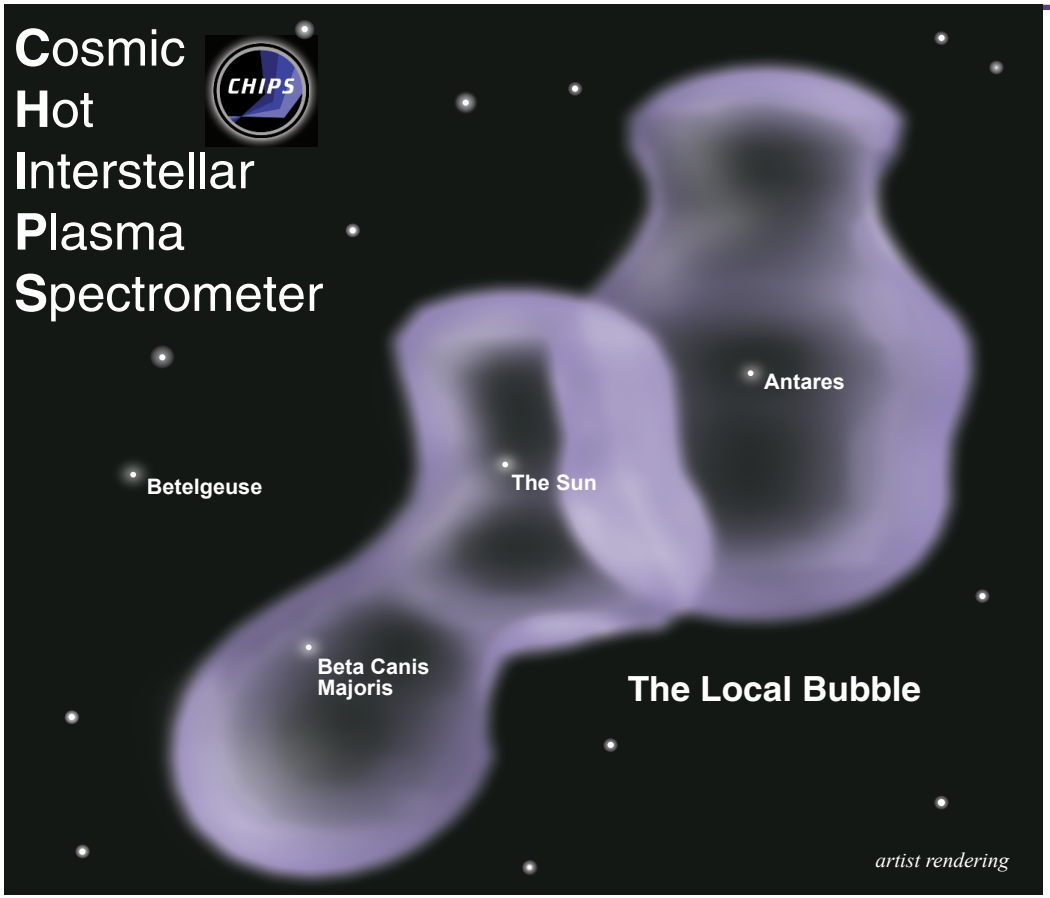
Cosmic Hot Interstellar Plasma Spectrometer

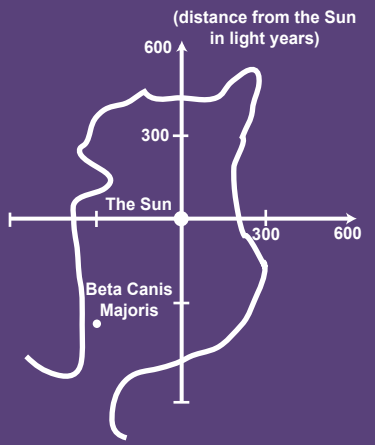


What are the ISM and the Local Bubble?

Most of us, at one time or another, have learned that space is a perfectly empty vacuum. But the vast space between the stars is really not empty, it is sparsely sprinkled with gas and dust. This 'stuff' between the stars is known as the interstellar medium (or ISM).

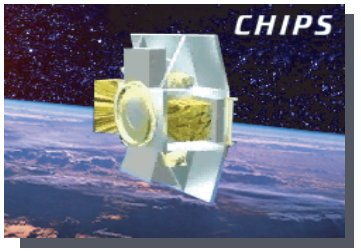
Our solar system is located in an unusual region of space called the Local Bubble (LB). The LB is a bubble of hot gas, about 300 light years in radius, surrounded by colder, denser gas in our galaxy. A coffee mug in the average ISM would contain about 500 Hydrogen atoms; in the Local Bubble, however, it would contain only 1–or perhaps none at all! This gas is also extremely hot, almost 200 times as hot as the surface of the Sun!

The Local Bubble is bordered by other bubbles which together give our galatic neighborhood a *swiss–cheese–like* structure. Astronomers believe our bubble may have been created by a supernova explosion ten million years ago—the explosion "blew" most of the gas and dust from the interstellar medium outward. It is this extremely diffuse gas, inside the Local Bubble, that the CHIPS misson will be studying.



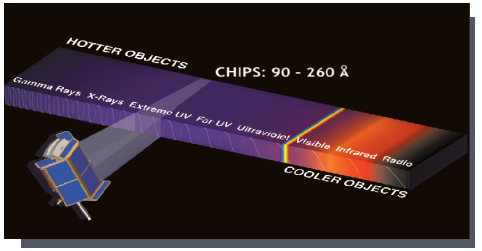
summary science results

MISSION



The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) is a University-Class Explorer (UNEX) mission at UC Berkeley funded by NASA. The CHIPS mission is dedicated to understanding how hot, million–degree gas in the Sun's local neighborhood (the local interstellar medium) cools. Studying how this gas cools will lead to a greater understanding of the nature of hot gas in our own and other galaxies.

CHIPS WILL:



- Be launched in spring/summer 2002
- Carry six small optics to separate different "colors" of extreme ultraviolet light.
- Look into the boundaries and distribution of hot gas within 300 light years of the Sun

EDUCATION & PUBLIC OUTREACH

Program Includes:

- Curriculum materials for grades 7-12
- Educator workshops presented at both local and regional professional conferences
- Basic CHIPS science (how things cool) classes at UC Berkeley's Academy Talent Development Program for grades 6-9
- Contributions to science education research in student's conceptual understanding of the particulate nature of matter
- Self-guided tutorial, Q&A on the scale, structure and our understanding of the Local Bubble
- Education and Public Outreach Website describing the mission science http://cse.ssl.berkeley.edu/chips

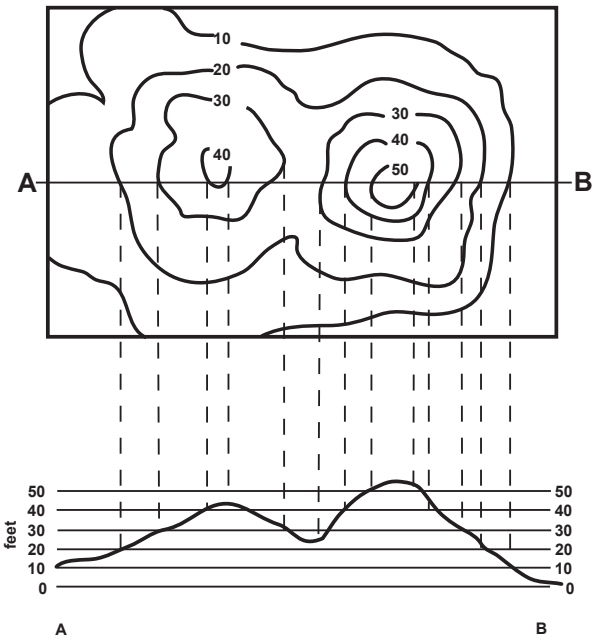
NASA · The Center for SCIENCE EDUCATION · CALIFORNIA SPACE GRANT

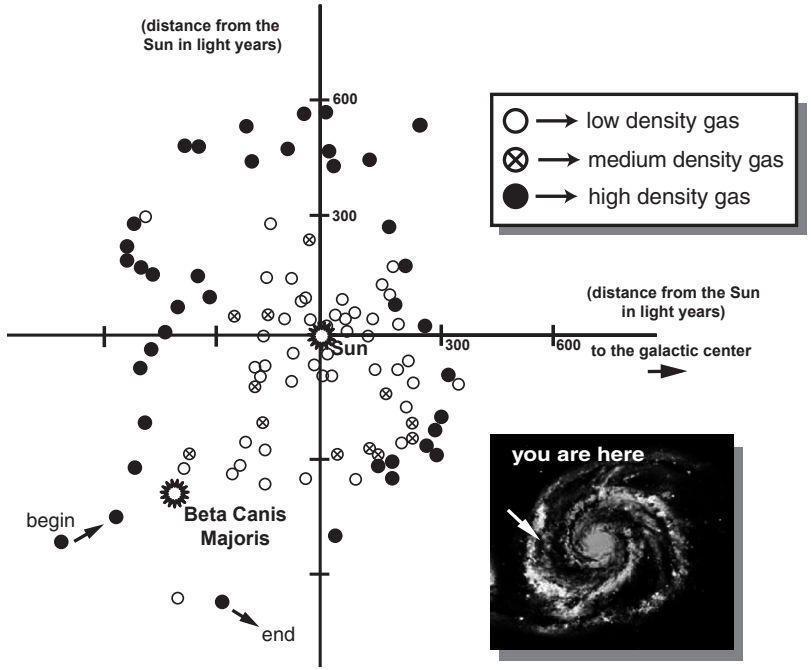
Plot the boundary of our Local Bubble: The Sun's local neighborhood

Understanding Contour Boundaries:

The images below show different ways of representing the elevation of the land near two hills. The bottom image shows a side view of the hills. You should be able to see that left hill is slightly higher than 40 feet, and the right hill is a little higher than 50 feet. This information is represented in a different way in the top image.

The top image shows the hills as if you were looking down on them from above. Each line in the top image represents a boundary line, or contour, of constant elevation. For example, the outer contour line is marked by the number 10. Everything outside this line is lower than 10 feet and every thing inside is higher than 10 feet. Each contour represents an increase in elevation. The innermost circles show you that the left hill has a peak which is higher than 40 feet, while the right hill has a peak which is higher than 50 feet.





Our solar neighborhood, looking down onto the galatic plane. The center of the galaxy is to the right, as shown in the small inset.

The image above shows density measurements of the gas which exists in the region around our Sun. Open circles indicate measurements of low density gas. Cross marked circles indicate measurements of medium density gas, and solid dots show the regions where the gas was measured to have the highest density.

Connect the black dots in the image above to reveal the contour inside which there is no high density gas. This region is known as the Local Bubble. Compare your contour with the science results on the front side. An interesting feature of the Local Bubble is the *tunnel* which extends out to the lower left side. Scientists are still working to understand the shape and origin of the Local Bubble, which extends out from the Sun to a distance of about 300 light years (a light year is the distance light travels in one year).

QUESTIONS:

1. Why is the Local Bubble almost spherical? (Hint- think about its creation)
2. The CHIPS satellite will be in orbit around the Earth and detect data from distant gas. Will CHIPS be looking at gas at the edge of the bubble, gas on the inside of the bubble, or gas outside the bubble?
3. Assuming the Local Bubble is spherical, with a radius of 300 light years, what would be the volume of this bubble?
4. Astronomers use units of parsecs for measuring large astronomical distances, where 1 parsec = 3.26 light years. What is the volume of our Local Bubble in cubic parsecs?

Check your answers at http://cse.ssl.berkeley.edu/chips/QandA.html **Please send questions to outreach@ssl.berkeley.edu**