Signals from the Cosmos: Deciphering Messages from the Stars

Astronomy is an observational science. As much as we dream about them, we cannot visit the stars in person to gather data. Instead we must rely on messages the stars send to us. These messages are coded into the various wavelengths of electromagnetic radiation (EMR) thrown out into space by the titanic physical and chemical processes taking place in the stars. As our messages of collecting and decoding the EMR messages improved over the ages, we gained a deeper understanding of the processes taking place in the universe, and the scientific laws that govern them. Each band of EMR provides new and different sets of information that lead to new levels of understanding the cosmos.

The human eye was the first EMR detector. It is programmed to detect the visible light band of the electromagnetic spectrum. It was visible light, first with the unaided eye, then through increasingly complex visible light aids (such as the telescope and spectrometer) that traced the history and development of astronomy from ancient peoples through the present. As technology developed in the 20th century, scientists were able to decode other bands of EMR: radio, infrared, ultraviolet, x-ray, and gamma ray, each adding new levels to our understanding of the universe. The Chandra Observatory is designed to detect, collect, and decipher the x-ray signals emitted by objects in the cosmos.

X-rays are extremely high energy radiation produced by some of the most violent processes in the universe. An object emitting x-rays has a temperature exceeding 10 million Kelvin. Supernovas and black holes are two types of objects Chandra is focusing on. Cassiopeia A (Cas A) and the Crab Nebula are the remnants of two supernovas. Chandra has gathered a wealth of data on these two objects. What can you learn about these two celestial bodies from the EMR signals hurled toward us by the titanic explosions that destroyed two doomed stars and metamorphosed them into supernovas?

Your Task:
Imagine you are an astrophysicist working with the Chandra Project. You have been assigned to the Interpretation Department. Your job is to take the messages from either Cas A or the Crab Nebula that have been deciphered by the Code Breaking department, and determine what they mean. Without your work, the information is just that, information. You are the storyteller! Just as a poet takes words and arranges them, bringing images to life, you will take cold, hard,

impersonal scientific data and "paint" a picture of a cosmic object – Cas A or the Crab Nebula.

To complete this task, you will need to log on to the Chandra Web site at: http://chandra.harvard.edu. Here you will find links to background information and data collected and decoded by other scientists on the Chandra team.

Review, analyze, and make sense of the data and information on this site. Choose one of the two supernovas and get to know it well. Create a picture/story of the life, death, and rebirth of your chosen cosmic creation. Describe how we "know" the story, based on the tools, technology, and scientific evidence available . You may present your story of the supernova in one of these three forms:

1. A scientific paper, including graphics, written for the Journal of X-Ray Astrophysics, a formal peer reviewed journal read by professional astronomers.

2. A less formal, more creative story, including graphics, written for Discovering Astronomy, a popular lay magazine for amateur astronomers.

3. A poster that translates your research into pictures and text that can be understood by the general public.

For reference, a hardcopy set of all of the documents you downloaded, and used, from the Chandra web site will be handed in as an Appendix to your paper/story/poster.