

Rossi X-ray Timing Explorer

Mission

The Rossi X-ray Timing Explorer (RXTE), named after astronomer Bruno Rossi, probes the physics of cosmic X-ray sources by making sensitive measurements of their variability over time scales ranging from milliseconds to years. How these sources behave over time is a source of important information about processes and structures in white-dwarf stars, X-ray binaries, neutron stars, pulsars, and black holes.

RXTE satellite was launched on Dec. 30, 1995. With instruments sensitive to a wide range of X-ray energies, RXTE is designed for studying known sources, detecting transient events, X-ray bursts, and periodic fluctuations in X-ray emissions.

Scientists use RXTE to study:

- periodic, transient, and burst phenomena in the X-ray emission from a wide variety of objects,
- the characteristics of X-ray binaries, including the masses of the stars, their orbital properties, and the exchange of matter between them,
- the inner structure of neutron stars, and properties of their magnetic fields,
- the behavior of matter just before it falls into a black hole,
- effects of general relativity which can be seen only near a black hole,
- properties and effects of supermassive black holes in the centers of active galaxies,
- and the mechanisms which cause the emission of X-rays in all these objects.

Education & Public Outreach

The RXTE Learning Center Web site contains a wealth of information about:

- the mission,
- X-ray astronomy, and
- RXTE discoveries.

The Web site also includes:

- images and movies,
- RXTE satellite model,
- lesson plans,
- a tour of the X-ray sky, and
- RXTE data from over 100 X-ray sources.

Classroom Visits:

RXTE data from an eclipsing binary were used by competing classrooms to predict future eclipses. RXTE team members visited the winning school and enabled them to actually watch the next eclipse via the Science Operation Facility's Real-Time Remote Observing Web page.

Online Booklet:

“Shedding a New Light on the Universe,” an exploration of the electromagnetic spectrum and multiwavelength astronomy, focusing on X-ray astronomy.

The RXTE Web site can be found at
http://rxte.gsfc.nasa.gov/docs/xte/learning_center/

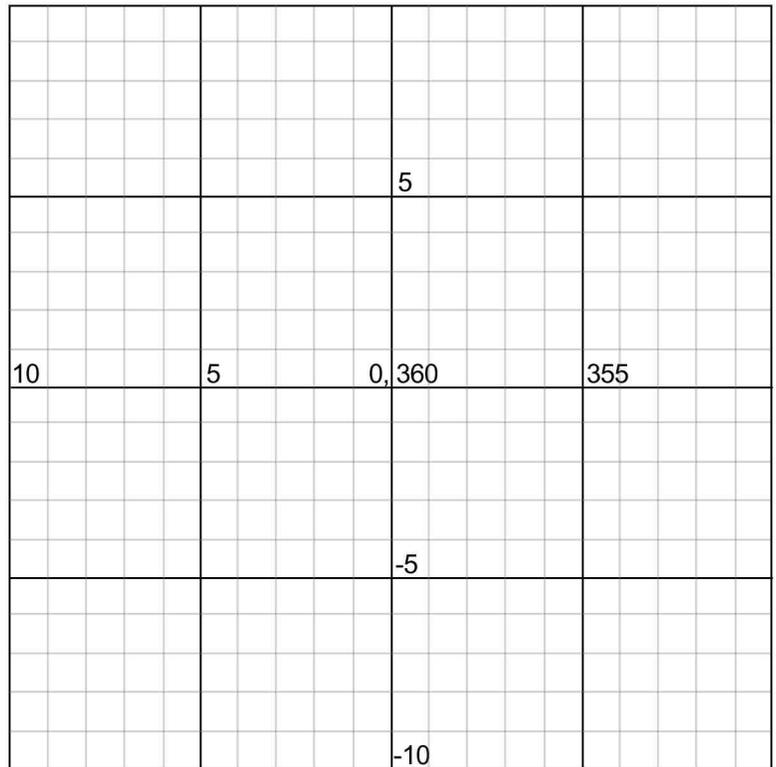
Make Your Own X-ray “Weather” Map

You will need

- 1) red and blue colored pencils
- 2) a metric ruler
- 3) a compass

Plot the data below on the graph to the right so your fellow scientists can tell the location of the source, whether the source is bright or not, and if it’s getting brighter or dimmer.

If today’s average flux is greater than yesterday’s, use your blue pencil. If today’s average flux is less, use your red pencil. Plot a circle with a diameter of 1 cm for every 10 units of today’s flux. If today’s flux is 14, draw a 1.4 cm diameter circle centered on the Galactic Latitude (*b*) and Longitude (*l*). Don’t worry if your circles overlap.



Source Name	Type	Galactic Coordinates		Today's	Yesterday's
		<i>l</i> (Deg.)	<i>b</i> (Deg.)	Average Flux	Average Flux
GCX-1	Unknown	359.56	-0.38	2.25 ± 0.48	4.52 ± 0.48
GROJ1744-28	LMXB*	0.05	0.30	2.28 ± 0.48	2.63 ± 0.47
GRS1758-258	BHC†	4.51	-1.36	22.60 ± 0.63	32.40 ± 0.73
GX1+4	X-ray Pulsar, LMXB	1.93	4.79	6.30 ± 0.63	6.09 ± 0.51
GX3+1	LMXB	2.30	0.80	18.98 ± 0.64	20.00 ± 0.55
KS1731-260	Neutron Star, LMXB	1.07	3.66	14.05 ± 0.70	13.83 ± 0.55
SL1735-269	X-ray source	0.79	2.40	1.07 ± 0.60	0.82 ± 0.56
X1724-307	Globular Cluster	356.32	2.30	2.45 ± 0.48	2.25 ± 0.47
X1755-338	LMXB	357.21	-4.88	-0.09 ± 0.45	0.24 ± 0.48

*LMXB: Low Mass X-ray Binary. A binary star system containing a neutron star or a black hole and a normal companion star that loses mass to the compact object via an accretion stream.

†BHC: Black Hole Candidate. A system containing a compact object of mass greater than 3.2 times our sun’s mass, thought by scientists to be the upper mass limit of a neutron star. Anything greater than this mass will collapse under its own gravity to form a black hole.

Why do some of these sources have names like telephone numbers? You used *galactic coordinates* to plot your data. The Galactic Center is at 0,0 in this coordinate system and the plane of our galaxy (commonly called the Galactic Plane) lies along the X axis. The objects with long “phone number” names are actually the source locations in another coordinate system, the *equatorial coordinate system*. In this coordinate system, the earth’s equator is projected onto the celestial sphere and longitude is divided into 24 hours (360 degrees). In equatorial coordinates, the Galactic Center lies at about 17.5 hours in Right Ascension and -28 degrees in Declination. The objects that have GX or GCX in their names stand for Galactic X-ray source or Galactic Center X-ray source. The numbers that appear after GX are in galactic coordinates and so are very close to the *l* and *b* values you plotted. All the objects above are in the general direction of the Galactic Center.

Questions:

- 1) How many objects plotted here are currently getting brighter?
- 2) How many objects are South of the Galactic Plane?
- 3) Which source is closest to the Galactic Center?

Answers: 1) Four objects were brighter today than yesterday (GX1+4, KS1731-260, SL1735-269, and X1724-307). 2) Three objects are south of the Galactic Plane (GCX-1, GRS1758-258, and X1755-338). 3) GROJ1744-28 is the closest of these sources to the Galactic Center.