# Astro Apocalypse Won't Happen Here

Thu, 20 Apr 2006 - Since gamma ray bursts release a torrent of radiation visible across the Universe, it goes without saying that we wouldn't one to blow up near us. Well, don't worry. According to researchers at Ohio State University, our Milky Way is the just wrong type of galaxy for potential bursts - they almost always happen within small, misshapen galaxies that lack heavy chemical elements. That's good news, since a burst within 3,000 light years of the Earth would give us a lethal dose of radiation.

## Full article

The afterglow of GRB 030329 (white dot in center of image).
Image credit: ESA/NASA. Click to enlarge
Are you losing sleep at night because you're afraid that all life on Earth will suddenly be annihilated by a massive dose of gamma radiation from the cosmos?

Well, now you can rest easy.

Some scientists have wondered whether a deadly astronomical event called a gamma ray burst could happen in a galaxy like ours, but a group of astronomers at Ohio State University and their colleagues have determined that such an event would be nearly impossible.

Gamma ray bursts (GRBs) are high-energy beams of radiation that shoot out from the north and south magnetic poles of a particular kind of star during a supernova explosion, explained Krzysztof Stanek, associate professor of astronomy at Ohio State. Scientists suspect that if a GRB were to occur near our solar system, and one of the beams were to hit Earth, it could cause mass extinctions all over the planet.

The GRB would have to be less than 3,000 light years away to pose a danger, Stanek said. One light year is approximately 6 trillion miles, and our galaxy measures 100,000 light years across. So the event would not only have to occur in our galaxy, but relatively close by, as well.

In the new study, which Stanek and his coauthors submitted to the Astrophysical Journal, they found that GRBs tend to occur in small, misshapen galaxies that lack heavy chemical elements (astronomers often refer to all elements other than the very lightest ones -- hydrogen, helium, and lithium -- as metals). Even among metal-poor galaxies, the events are rare -- astronomers only detect a GRB once every few years.

But the Milky Way is different from these GRB galaxies on all counts -- it's a large spiral galaxy with lots of heavy elements.

The astronomers did a statistical analysis of four GRBs that happened in nearby galaxies, explained Oleg Gnedin, a postdoctoral researcher at Ohio State. They compared the mass of the four host galaxies, the rate at which new stars were forming in them, and their metal content to other galaxies catalogued in the Sloan Digital Sky Survey.

Though four may sound like a small sample compared to the number of galaxies in the universe, these four were the best choice for the study because astronomers had data on their composition, Stanek said. All four were small galaxies with high rates of star formation and low metal content.

Of the four galaxies, the one with the most metals -- the one most similar to ours -- hosted the weakest GRB. The astronomers determined that the odds of a GRB occurring in a galaxy like that one to be approximately 0.15 percent.

And the Milky Way's metal content is twice as high as that galaxy, so our odds of ever having a GRB would be even lower than 0.15 percent.

"We didn't bother to compute the odds for our galaxy, because 0.15 percent seemed low enough," Stanek said.

He figures that most people weren't losing sleep over the possibility of an Earth-annihilating GRB. "I wouldn't expect the stock market to go up as a result of this news, either," he said. "But there are a lot of people who have wondered whether GRBs could be blamed for mass extinctions early in Earth's history, and our work suggests that this is not the case."

Astronomers have studied GRBs for more than 40 years, and only recently determined where they come from. In fact, Stanek led the team that tied GRBs to supernovae in 2003.

He and Gnedin explained that when a very massive, rapidly rotating star explodes in a supernova, its magnetic field directs gamma radiation to flow only out of the star's north and south magnetic poles, forming high-intensity jets.

Scientists have measured the energies of these events and assumed -- rightly so, Stanek said -- that such high-intensity radiation could destroy life on a planet. That's why some scientists have proposed that a GRB could have been responsible for a mass extinction that occurred on Earth 450 million years ago.

Now it seems that gamma ray bursts may not pose as much a danger to Earth or any other potential life in the universe, either, since they are unlikely to occur where life would develop.

Planets need metals to form, Stanek said, so a low-metal galaxy would probably have fewer planets, and fewer chances for life.

He added that he didn't originally intend to address the question of mass extinctions. The study grew out of a group discussion during the Ohio State Department of Astronomy's "morning coffee" -- a daily half-hour where faculty and students review new astronomy journal articles that have been posted to Internet preprint servers overnight. In February, Stanek published a paper on a GRB he had observed, and during coffee someone asked whether he thought it was just a coincidence that these events seem to happen in small, metal-poor galaxies.

"My initial reaction was that it's not a coincidence, and everyone just knows that GRBs happen in metal-poor galaxies. But then people asked, 'Is it really that well known? Has anybody actually proven it to be true?' And we realized that nobody had."

As a result, the list of coauthors on the paper includes astronomers across a broad range of expertise, which Stanek said is somewhat unusual in these days of specialized research. The coauthors were among faculty gathered for coffee that day, plus a few friends they recruited to help them: Stanek and Gnedin; John Beacom, assistant professor of physics and astronomy; Jennifer Johnson, assistant professor of astronomy; Juna Kollmeier, a graduate student; Andrew Gould, Marc Pinsonneault, Richard Pogge, and David Weinberg, all professors of astronomy at Ohio State; and Maryam Modjaz, a graduate student at the Harvard-Smithsonian Center for Astrophysics.

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