

The Violent Universe

An introductory astronomy course with Prof. Andrew Fraknoi
At The Fromm Institute, San Francisco



When most people think of astronomy, they picture the peaceful sky with twinkling stars, the same night after night. But our modern view of the universe is of a place with many opportunities for great violence – violence that can turn planets unlivable, blow stars to smithereens, and even disturb entire galaxies. We will discuss what our modern understanding tells us about cosmic violence. The course is for the beginner in science; no knowledge of math or science will be assumed or needed.

Professor Fraknoi will set the scene for each discussion, so that students have the background they need to appreciate the violent process being discussed. Illustrated with images from the world's top telescopes, and laced with some humor, the course will illuminate the latest ideas from astronomy in an accessible, enjoyable way.

TOPICS:

1. Overview of the Universe with an Eye on Violence

We will tour the universe, from nearby planets to distant galaxies, with an eye toward seeing where (and on what scales) violence may play a role. During this initial tour, we will look at spectacular weather on other worlds, including giant storms, sulfuric acid rain, explosions on the Sun, and more

2. Rocks from Space and Their Impacts

Meteorites (rocks that fall from space from time to time) have hit houses, cars, and people. Some larger rocks have exploded on impact, causing wide devastation. We'll discuss cosmic impacts and their effects in some detail. You'll hear about the fireball over the Russian town of Chelyabinsk in 2013, the ancient explosion that created the Barringer Crater that is now a major tourist attraction in Arizona, and the horrific impact 65 million years ago that killed the dinosaurs, and half the living species on Earth with them. It could happen again. What would we do if it did? Don't worry, scientists and the US military actually have plans now, which we'll discuss.

3. The Lives and Gruesome Deaths of Stars

Stars are not forever. Although they live a lot longer than people, all stars eventually run out of fuel and die. Some stars end their lives by exploding, blowing themselves and their planets to bits. Such star explosions can make neighboring star systems uninhabitable too. At the same time, such explosions turn out to be absolutely crucial for the development of life in the universe. We'll discuss why. We'll look at some well-known past explosions (including one that outshone the Sun in our skies) and then ask if any stars in our neighborhood might be getting ready to explode.

4. Black Holes: Where Gravity Overwhelms Every Other Force

When the largest stars die, they collapse until gravity becomes strong enough to warp both space and time and create a mind-boggling object called a black hole. Such black holes are only seen when they violently disrupt a neighbor star, consuming much of it for lunch. We examine some of the star systems where black holes have revealed their existence through violent acts, and talk about why visiting a black hole might be a once-in-a-lifetime experience.

5. Supermassive Black Holes and Quasars: Violence that Tears Apart Galaxies

We now move to the realm of the galaxies – vast systems of billions of stars which are the building blocks of the universe. Such galaxies are often so close to each other, they can, over cosmic times, actually collide. In the almost unimaginable violence of these collisions, black holes can grow to immense size and can produce vast jets that disturb the whole galaxy in which they occur. The most active of these violent galaxies are called *quasars* and we end the class by examining how badly they disturb the whole cosmic neighborhood in which they live.

Andrew Fraknoi retired in July 2017 as the Chair of the Astronomy Department at Foothill College, having taught introductory astronomy and physics at three different colleges (including SF State). He was the California Professor of the Year in 2007. Fraknoi is the lead author of *Astronomy*, a popular introductory textbook, published in a free open-source edition by the non-profit OpenStax project at Rice University. He keeps a website cataloging science fiction stories based on good astronomy, and has published three science fiction stories of his own in recent years. Asteroid 4859 has been named Asteroid Fraknoi by the International Astronomical Union in recognition of his contributions to the public understanding of science, but it won't crash into Earth!

A separate reading list "for further exploration" will be distributed
