Searching for a cancer treatment
in the stars

Ohio State astronomers say they’ve found a unique way to target malignant cells

By Molly Gray

It is not uncommon to find inspiration in the stars. But a possible cancer treatment? Ohio State University researchers think their work with huge regions of space might lead to a way to kill the smallest cancer cells. After studying how different elements absorb and emit radiation in stars and around black holes, OSU astronomers are working with cancer experts to create a radiation treatment that is tougher on malignant tumors than current treatment yet won’t damage the rest of the body.

Astronomers Anil Pradhan and Sultana Nahar propose that their concept, called Resonant Nanoparticle Therapy, can use X-rays to target malignant cells in hopes of destroying them. They say their work with OSU’s Chandra X-ray Observatory is the key to understanding cancer treatment.

“Being in the atomic physics, we can at least tell you if there is something there and you can try to locate it,” Pradhan said. “But it’s not possible for you to tell me what’s inside the electron or what’s inside the star. So the astronomers do the difficult part and leave the easy part to us. But once the electron or star is detected, we can probably analyze it. It’s almost like a joint collaboration between the astronomers and the astrophysicists.”

Their work started during their time working with NASA’s Chandra X-ray Observatory. X-ray telescopes give a more comprehensive view of the universe, but they can’t detect objects in the same way as optical telescopes. X-ray telescopes basically have two components: a large mirror and a detector.

Astronomers zoom in on X-rays emitted from a star’s surface and use the mirror to angle them toward the detector, which is made up of hundreds of tiny silicon pixels. “The X-rays cause...”

“The X-rays cause...”

“The X-rays cause...”

“The X-rays cause...”

The Chandra X-ray Observatory and the Hubble and Spitzer space telescopes were used to make this image of the Crab Nebula.

“Conventional types of treatment...”

“Conventional types of treatment...”

“Conventional types of treatment...”

“Conventional types of treatment...”

They selected gold and platinum for the nanoparticles because, as the 78th and 79th elements in the periodic table, they are heavy elements with large particles and can therefore be more effective against the malignant cells, Nahar said.

So how does all of this come into play as a cancer therapy? Nahar and Pradhan hope to marry X-rays with nanoparticle technology to better target radiation to a tumor, rather than sending it throughout the entire body. They say they can embed gold- or platinum nanoparticles into the patient’s tumor and then direct X-rays that will emit the element’s electrons to destroy the cancerous tissue.

“External X-rays go to the surrounding bad cells and destroy them, which is why it was important to find the frequency where the most electrons are being ejected,” Nahar said.

Nahar and Pradhan have been working with medical experts, including Yu. “It’s something like this — you plant a smart device into the tumor that you can later activate or stimulate by using highly-tuned X-rays,” Yu said. “The device will begin to expel electrons to the tumor and you can stop it when there is sufficient damage or you can continue it if the tumor is still active.

The concept also is being probed in the lab with other technologies, Pradhan said. Much like the physics processes used to photograph the stars, doctors should be able to use the expelled electrons to create an image of a tumor.

Yu said the idea of fighting tumors with electrons is revolutionary.

“Conventional types of treatment...”