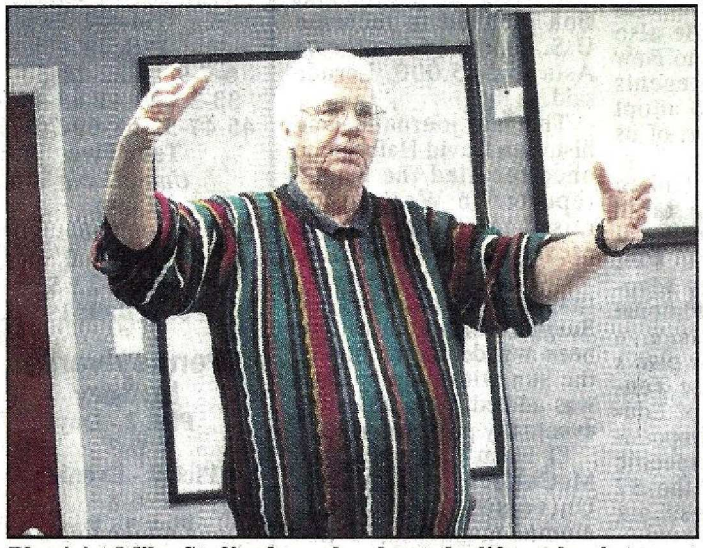
Physicist Delivers Presentation About Formation Of Stars

By Eric Zavinski
ezavinski@post-journal.com

FREWSBURG – The universe is full of cosmic bodies, perhaps the most important of which are stars. At the Martz-Kohl Observatory on Wednesday evening, physicist Mike Stafford attempted to explain the intricate makings of these floating balls of gas in space and how they live out their lives over billions of years.

In his presentation, "The Birth and Death of Stars," Stafford described how stellar objects of such size are able to hold together as one for so long, powering the solar systems and galaxies populated with them with light, heat and energy. Stafford began by saying there was a significant cool-down period after The Big Bang that allowed the nuclei of hydrogen and helium, the least massive elements, to form.

The theme of the smallest objects on the quantum level affecting the most massive on a solar level was prevalent throughout the lecture. Stafford said it was an irregularity in matter that allowed for the clouds of gas and dust that would become stars to coalesce.



Physicist Mike Stafford speaks about the life cycle of stars at the Martz-Kohl Observatory on Wednesday evening during his presentation titled "The Birth and Death of Stars."
P-J photo by Eric Zavinski

"It couldn't have been a perfectly uniform universe," Stafford said.

Stafford said that two important questions would be the key to understanding how stars work: what pulled a star together and what keeps it from collapsing completely.

The answer to the former was always gravity, that mass would be attracted to other mass and would be pulled to it. Things got more physics-intensive once the latter question came into play, but Stafford explained the key processes to the audience nonetheless.

He started with our local star, the sun. Our sun, which is 93 million miles away and "nothing in astronomy" distance-wise, is held together by gravity. That force brought hydrogen and helium together, causing a process to take hold called nuclear fusion. The radiation from this process in which hydrogen gets smashed together to form helium is what keeps the star from collapsing in on itself.

That explains how stars were created and how they stay together, but Stafford and his audience ventured further to investigate what happens once nuclear fusion cannot happen anymore. Hydrogen runs out in about 5 billion years for our sun, and when that happens, the radiation energy that kept the sun from collapsing disappears. Gravity then causes a collapse.

Helium fuses to create carbon, which yields a higher temperature. This also means planets Mercury, Venus and even Earth would get wiped out in this larger set of fusion reactions. After this happens, the sun will become a red giant, off the scale of main sequence stars.

"This can't go on forever," Stafford said, so a collapse is imminent for the sun. Carbon will not fuse; a planetary nebula forms as mass is lost.

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A more dense star originates from the core. It is called a white dwarf and is no longer held together by fusion reactions. Instead, electron degeneracy goes into effect, meaning electrons that are pulled so closely together in the dense white dwarf cannot possibly share the same quantumn number, or space rather, and therefore must push against each other.

Stars bigger than the sun cause supernovae to occur. These massive explosions leave neutron stars lingering in their path. Heat becomes such an astronomical factor that, depending on the size of stars, different parts of the life cycle can come to fruition.

The professor also took the time to talk about Stephen Hawking's work and called the deceased physicst a "black hole specialist." Getting into the subject of anti-matter, Stafford explained that "every particle there is – electron, proton, neutron – has an antiparticle."

Stafford said that positron (or antielectron) production on the event horizon or edge of a black hole actually causes black holes to grow smaller. The smaller a black hole is, the faster it will evaporate. He said that small black holes evaporate and create bursts of gamma rays when they explode.

"The matter in our bodies was once in a supernova," Stafford said. "Every one of us originated in the stars. We are stardust."

The next lecture at the Martz-Kohl Observatory will be given by Ted Wolf on June 20.