“DARK ENERGY AND THE RUNAWAY UNIVERSE”

By: David Smith

A world-renown, University of California astronomy professor shared his knowledge about “Dark Energy and the Runaway Universe” at Embry-Riddle Aeronautical University.

Dr. Alexei Filippenko, who was part of a team that con-firmed the expansion of the universe, was greeted with near-unanimous applause as he was introduced by Dr. Charles Vuille as lecturer for the 8th Annual Elston Memorial Lecture on Gravitation.

The yearly talk which featured Princeton University’s “Albert Einstein Professor in Science” in April - is presented by Cengage Publishing, the ERAU College of Arts and Sciences (COAS), and the ERAU Elston Fund. It also marked the second event in the 2008-2009 Arts and Letters Committee Series, an arm of the ERAU COAS.

Dr. Vuille, an ERAU physical sciences professor, credited Filippenko as being equally proficient in astronomy and tennis.

“This talk is about cosmology,” Dr. Filippenko said. He described it as a science that seeks to understand the structure of the universe as a whole. It also seeks to deter-mine the origin and fate of the universe.

The process of expansion has not been uniform throughout the universe’s history and there is much to be learned about the nature of dark energy and matter. In addition, technology has played a key role in cosmology, given the importance of observing celestial bodies and events (like supernova).

Galaxies, Filippenko said, are the “building blocks of the universe.”

“A central figure in this field [cosmology] was Edwin Hubble,” he said.

Hubble’s 1929 discovery of galaxy recession was made by passing the light of distant galaxies through a prism. This method caused the light to shift according to its distance, with redder colors indicating increasing distances, similar to a Doppler effect.

The red-shift observed by Hubble gave him reason to believe that “more distant galaxies are moving faster than near-by ones,” Dr. Filippenko said.

He demonstrated the phenomenon by stretching an elastic rope with a number of ping-pongs attached like weather balloons. The balls were considered galaxies. And the separation after Dr. Filippenko stretched the rope showed the middle galaxy was twice as far away from outer ones. This is compared to the near-by galaxies, whose separation was less due to their initial proximity.

The legacy of Hubble is that “we now have the present-day expansion rate of the universe.”

“If you have a Big Bang, then you are going to have a Big Crunch,” Filippenko said. He demonstrated this concept as a function of simple gravity and paid tribute to Sir Isaac Newton with the toss of a fake apple.

In principle, he said, we can find the fate of the universe by gazing into the past. He explained the eight minute delay of light to travel from the Sun to Earth, and that the universe’s history is encoded in light from galaxies situated billions of light years away.

While it is easy to determine the distance of nearby stars, the far ones are difficult.

But this is overcome when astronomers can locate a Type 1a supernova, an explosion resulting from the thermonuclear runaway of a white dwarf at its maximum dust. Using a similar procedure as Hubble’s prism, the stretching of light from eruptions helps determine the velocity of far-away galaxies.

The award-winning professor stated the Sun would not be on this path in the future, and shared that these events expel many elements and atoms that make up every-thing on Earth, the moon, and beyond.

Ten years ago, as a member of a team competing against another for the efficient discovery of these supernovae, Filippenko gained recognition when observations led to the conclusion that the universe’s expansion is accelerating.

In fact, the discovery earned Filippenko’s team the honor of 1998‟s top science break-through by Science magazine.

Yesteryear’s cosmologists, like Albert Einstein, believed in a static universe. Einstein postulated an anti-gravity force as necessary to explain why galaxies aren’t attracted to each other, but had no means of confirmation.

“He was sad that he ever introduced the idea,” Filippenko said. But the recent work of astronomers has resuscitated it.

The theory of repulsion is such that accumulation of repulsive forces (opponents of gravity) creates expansion, which has staved off collision.

Using the Hubble Space Tele-scope, astronomers have viewed 8-9 billion years into the past and noticed a change in the pattern.

For the first nine billion years, the universe’s expansion decelerated; for the last 4 billion there has been a period of acceleration.

In the 1930s, Caltech professor Dr. Fritz Zwicky discovered dark matter, which serves to attract clusters, or groups, of galaxies together.

“Dark matter is attractive, dark energy is repulsive,” the

University of California, Berkeley professor said. While 73% is made of dark energy, 23% is dark matter. That leaves only 4% of universal materials that are under-stood by men.

The hope, Filippenko said, is to unify the two pillars of physics: Classical-Newtonian, and Quantum, or subatomic-particle.

In regards to the fate of the universe, Filippenko explained it would depend on whether dark energy would again change its pace, as it did 4+ billion years ago.

Two options for the universe's conclusion, which were pondered by poet Robert Frost, would be fire if it recollapses or ice if expansion continues. Although Frost preferred and predicted a fiery demise, Filippenko noted that in his work Frost was resigned to accept a big chill as an ending too.

At the conclusion of the hour-and-a-half presentation, Filippenko fielded questions from various ERAU faculty and students among the packed auditorium.