

## OLLI Course Bio

Prof. Basri taught in the Astronomy Dept. at UC Berkeley for 35 years. His favorite classes were the introductory courses for non-majors and small freshman seminars. He enjoys making science accessible to the general public, and has been given the Sagan award for this talent. He has recently also taught several well-received OLLI classes.

## Title: Cosmic Origins

Even early humans looked up at the sky and wondered what they were seeing. The skies are inextricably tied to our spiritual understanding of ourselves and our surroundings. Modern science's explanation of the Universe is very different from those before, though perhaps not any less strange. Starting with the "cosmologies" of various cultures a few thousand years ago, I'll describe and explain the history of the various observations, insights, and tests that have led to the current – very empirical – conception of the Universe.

Supplementary Reading: Coming of Age in the Milky Way  
by Timothy Ferris

## Syllabus      **WAKING UP IN THE UNIVERSE.      2023**

### **Week 1    April 3      Primitive Astronomy**

We start with the astronomy that almost all primitive cultures had. The phases of the Moon and the motions of heavenly objects were obvious to all after dark. Astrology (which I will briefly critique) arose and other beliefs about the heavens (eclipses, comets, etc.) were sometimes important. I'll explain how all these phenomena really work. We'll also talk about timekeeping and calendars in civilizations, leading up to our current practices. All cultures have stories about the creation of the heavens, Earth, and life. Those could fill a course by themselves, so I will just briefly sample a few.

## **Week 2    April 10    Ancient Astronomy**

Before the Renaissance almost everyone believed that the Earth was the fixed center of the Universe. Most (but not all) also thought it was flat. There were good reasons for this, tied to an intuitive (but incorrect) view of physics. By about 2500 years ago, geometry and mathematics began to be employed to try to pin things down. Questions like the size and distance of the Moon and Sun and size and shape of the Earth were explored. The motions of the planets were a real puzzle; there were serious attempts to explain them that ended up working pretty well. I'll explain (without equations) how a few thinkers around the world were able to reach some roughly modern conclusions, but these were not widely adopted.

## **Week 3    April 17    The Birth of Scientific Astronomy**

The modern understanding of the motions of the planets and the layout of the Solar System happened in the 16th and 17th century. The history of how this unfolded has many human foibles, false starts, and tangles that you may not have heard of. This is the story of how modern science started and how the need for improved data is closely tied to theoretical progress. I will also discuss the cultural and religious forces that were also part of this fundamental change in how humanity views the cosmos. During this era, other branches of “natural philosophy” also began to bloom, some of which were important to later advances in astronomy.

## **Week 4    April 24    Reaching for the Stars**

Once the fundamentals of orbital motion were understood, it was still unclear how big the Solar System is or how far away the stars are. Neither of these are easy to determine, and there were many interesting (often failed) attempts to set the scale of things. Not only was the development of new instruments and methods important, but people had to devote the time, effort, and money into pursuing

these “impractical” questions. During the 18th and 19th century the answers came slowly. Telescopes got better and better, leading to the discovery of new planets in the Solar System.

## **Week 5    May 1        Waking up to the Galaxy**

By the beginning of the 20th century, we understood that the nearby stars are very far away, and began to determine the size, shape, and contents of the Milky Way Galaxy. It was first thought to be the whole Universe, but as physics and observations improved it became clear that ours is only one of nearly countless galaxies extending outward in a vast Universe. Methods for understanding what stars are made of and how they shine also appeared with improved understanding of atoms, nuclear physics, and the electromagnetic spectrum. Modern astrophysics has now rendered almost all cosmic objects comprehensible through earthly experiments and observations.

## **Week 6    May 8        Waking up to the Universe**

After the discovery of galaxies, the Universe was thought to be infinite and unchanging in time and space. Einstein’s relativity and Hubble’s discovery of the expansion of the Universe led to a very different picture. We began to apply physics and observations to the question of when and how the Universe began. From the 1960s onward, cosmology became an increasingly empirical branch of astrophysics. The discoveries of dark matter and dark energy leave us still perplexed about very fundamental and important aspects of the Universe that the next generations can work on. At the same time, we discovered that planets are common, and the quest for life elsewhere in the Universe is really on.