In Memoriam
Leo Blitz
Professor of Astronomy, Emeritus
1945-2022

Leo Blitz, emeritus professor of astronomy and former director of the Radio Astronomy Laboratory at the University of California at Berkeley, died peacefully on December 20, 2022, at his home in Sonoma, California with his loving family by his side, after a long battle with Parkinson's disease.

Leo was born in Munich, Germany on March 21, 1946. Leo's late parents, Abraham and Maria Blitz, met in Krakow, Poland, where Maria had grown up and survived the Krakow Ghetto, Plaszow, Auschwitz, Stutthof, and the January 1945 death march to Palmnicken, where she was among roughly 30 to survive the massacre of 13,000. Abraham, born in Poland and raised in Vienna, served in the Soviet army during WWII; he met Maria in 1945 while part of the Russian garrison at Krakow. For a successful emigration to the United States, Leo needed to be older and of a different nationality: his birth certificate was modified accordingly and his new date and place of birth became October 21, 1945, Krakow. In 1949, the Blitz family emigrated to Long Beach, NY, on Long Island, where Leo would spend every day playing at the beach.

Leo began his academic career at Cornell University, where he earned his undergraduate degree in Engineering Physics in 1967, and worked for six years as a nuclear engineer on safety aspects of nuclear power plants. Preferring to concentrate on pure science, he began his graduate work in astrophysics at Columbia University.

In 1976, as a graduate student at Columbia University, Leo's lifetime pursuit of molecular clouds and star formation began using a small (1.2-meter diameter) but brand new and technically advanced millimeter-wave telescope to make a simple map of the CO (carbon monoxide) molecule in and around a region of ionized gas known as the Rosette Nebula. At that time it was known that such nebulae were ionized by the light of newly-formed stars that lie within, and it was suspected that, generally, new stars were formed from the gas in large molecular clouds best imaged by emission from the CO molecule. However, specific examples of the implied association between ionized and molecular gas were rare. Leo believed that the Rosette was a textbook case and that there should be an observable association, but previous studies of the region had yielded no molecular gas. Leo expanded the map boundaries well beyond those used by previous attempts to include the possibility that the molecular gas component was off to the side. His hunch proved spectacularly correct, finding an example of what is now known as a Giant Molecular Cloud (GMC).

The approach of listening to his intuition and acting accordingly characterized Leo's research, and it was highly successful. A notable instance was the totally unanticipated discovery of a large population of smaller molecular clouds lying above and below the Galactic disk. Leo reasoned that smaller molecular clouds wouldn't fit the star-forming paradigm of GMCs, so he used large-scale optical photographs of the sky to locate suspicious regions of obscuration; with nearly 100% success, the regions showed the CO emission that traced molecular gas.

Another instance was Leo's taking advantage of the close relationship between regions of ionized gas, GMCs, and large-scale Galactic structure (such as spiral arms) to characterize the properties and structure of a galaxy. In particular, the velocity structure could be characterized by the CO molecular lines, and the distances could be determined from the regions of ionized gas. For the Milky Way Galaxy, this led to the important discovery that the rotational velocity is

constant ('flat') with respect to Galactic radius. The rotational velocity is determined by the mass distribution with radius, and a flat rotation curve meant lots of mass resides at large radii. But there wasn't anywhere near enough visible mass in the outer Galaxy! This was the discovery that 'dark matter' dominates the mass of our Galaxy.

Most of Leo's research centered on the star-forming process of GMCs. To study the process and establish trends you need large-number statistics, including objects with different environments and properties. The Milky Way Galaxy, within itself, doesn't have the full range, nor does it have enough GMCs for a well-characterized statistical sample. This leads to the necessity of locating and mapping molecular gas in external galaxies, which in turn leads to the attendant need for high angular resolution. This is the origin of Leo's interest in using spectral interferometry and aperture synthesis of the CO molecular lines to isolate individual GMCs in external galaxies. And, fundamentally, this is the reason he left the University of Maryland for UC Berkeley to take on the directorship of one of the great university millimeter-wave arrays--the 9-telescope Berkeley-Illinois-Maryland Association (BIMA) array.

Obtaining unbiased, large statistical samples requires treating individual members of a large sample identically, which is best done by organized surveys. Leo organized the enormous study imaging the CO molecule distribution in nearby, nearly face-on galaxies---the BIMA SONG (Survey of Normal Galaxies) survey. It confirmed the concept of young GMCs and showed how the star-formation rates within the GMCs changed a lot from one galaxy to another, with some being particularly prolific nurseries for star formation. These measurements and their interpretation are a crowning achievement of the BIMA array. The next step was to expand the number of galaxies studied, but BIMA wasn't sensitive enough. More telescopes!

Enter the Combined Array for Research in Millimeter-wave Astronomy (CARMA), a combination of six 10.4-meter telescopes (from Caltech), nine 6.1-meter (from BIMA), and eight 3.5-meter (from University of Chicago) telescopes. Needless to say, creating and fulfilling the concept of combining 3 different telescope designs from two university radio observatories and BIMA (which itself was a combination of 3 universities) required immense compromise, cooperation, and tact, and both the directors (including, of course, Leo) and the upper levels of administration of the 6 universities deserve enormous respect and credit for making CARMA a success.

For Leo, CARMA paved the way for a much broader survey project, the ATLAS 3D optical and millimeter-wave CO survey of 262 galaxies. This is a complete sample of early-type galaxies within the local (42 Mpc) volume, and involves an international collaboration among about 30 researchers with 4 PIs. Leo was not a PI but led the all-important CO mapping aspect, which observed the roughly 30 galaxies that have detectable CO using CARMA.

As 2022 marked the end of Leo's life, CARMA marked the end of the university-based millimeter-wave facilities in the U.S. They are succeeded by the internationally-based Atacama Large Millimeter Array (ALMA), which probes molecular clouds and star formation even deeper into the extragalactic universe.

Leo loved the human side of science as much as making discoveries. Many students and collaborators have fond memories of dinners and wide-ranging discussions on matters both scientific and human that went on long into the night. His zest for life, engaging personality, and enthusiasm for learning were contagious. He was a great communicator, in his talks, in his papers, and in his conversations. Naturally, many students wanted to work with him and over 30+ years, he mentored 16 students to the PhD level and at least 26 postdocs. Of his many worldwide colleagues, an unusually large number regard him not only as a stimulating scientific associate but also as a friend.

Along with the human side, Leo enjoyed many aspects of life. He liked physical activity and was a very competitive squash player; as an astronomer, he would seek out other aficionados. He and his wife Lidewij played lot of tennis together. He liked to take his sons fishing. One of the family's main activities was long bicycle rides. And Leo liked running--an activity that his son Efrem picked up to become a competitive cross-country runner. And he loved 'the good life'--opera, music, and good food served elegantly, especially goodies like gourmet chocolate.

Leo is survived by his wife Lidewij de Vries and their sons Abram and Efrem; his son Brian and his grandsons Benjamin and Samuel; and by his brother Andrew. Leo was deeply loved and will be greatly missed.

Carl Heiles
Timothy Robishaw
Jonathan Willlams
2023