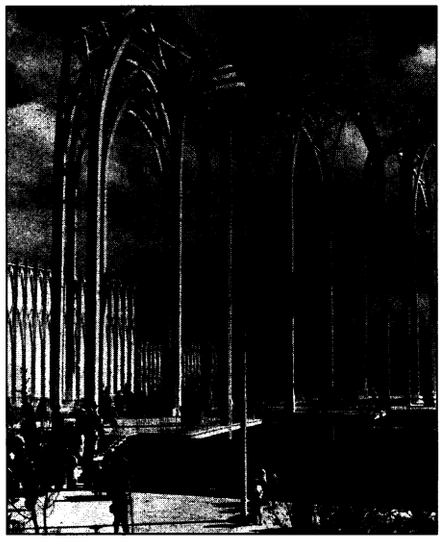

"Space Gothic in Seattle: the graceful arches of the United States Science Pavilion" at the 1962 World's Fair. [From *Redeeming Culture*; courtesy of United States Archives—Pacific Northwest Branch]

that appeared remote from the common sense and intuitive wisdom of the American people. William Jennings Bryan thus considered himself as much a "scientist" as anyone else. Just as the ordinary individual could read and learn from Scripture by himself, he believed, so could that individual understand science. And as in religion, the danger occurred when an elitist group of theorists sought to impose its esoteric doctrine (such as evolution) against the conventional wisdom of the shared culture of a given society. Today Bryan may appear more a curiosity than a representative voice. However, amid the great success of his *Worlds in Collision*, Velikovsky inveighed against scientists' refusal to take the book seriously (he had a theory that a comet struck the Earth around 1475 B.C., raining rocks on Joshua's enemies and wrenching the Earth from its orbit, thus "stopping" the sun). Velikovsky, comparing himself to the maligned Copernicus, accused scientists of becoming dogmatic and giving loyalty to a particular truth system, as in the Soviet Union. He appealed to the jury of democracy as the fairer test of his ideas and faulted elite institutions like Harvard University and the American Association for the Advancement of Science. Gilbert's book, therefore, should give us pause. Our contemporary populist culture reverberates with anti-elitism. Surely the interests of science do not stand to gain from it.

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# Galactic Reflections

**Bright Galaxies, Dark Matters.** VERA RUBIN. AIP Press (Springer-Verlag), New York, 1996. xvi, 236 pp., illus., + plates. $29.95 or £22.95. ISBN 1-56396-231-4. Masters of Modern Physics.

As understanding the evolution and ultimate fate of the universe is a major goal for astronomers, it is sobering to recall that it is only in the 20th century that we have learned the nature of galaxies. By the late 1800s the Herschels had found many "spiral nebulae," but it was not until the 1920s that Edwin Hubble identified these objects as "island universes" containing billions of stars quite separate from our own Milky Way. He went on to show that these galaxies are expanding away from each other in what we now call the Hubble Flow.

Today a wealth of information about the lumpy distribution, range of luminosities, dynamics, and masses of galaxies is available. They can no longer be thought of as "island universes" but rather are known to be dynamic, often interacting systems. We now know that galaxies and the clusters in which they reside contain not only the luminous matter that early observers studied but that the vast majority of mass lies in the form of dark matter whose nature is not yet understood. In spite of extensive observational and theoretical work during the last 50 years, we still do not know enough about the distribution of this matter and the properties of the expansion to know whether the universe will expand forever or collapse back on itself.

It is galaxies and what their dynamics can tell us about the universe that have fascinated Vera Rubin throughout her career. From observations of stellar motions in the nearby Andromeda Galaxy (M31) to investigations of the large-scale motion of the local supercluster, Rubin's work has been centered on stellar motions in galaxies and the evidence that they provide showing that most of the matter in the universe is dark.

*Bright Galaxies, Dark Matters* is a collection of some of Rubin's papers, popular articles, and talks, connected by brief remembrances placing them in context.

The first group of papers, Galaxies, ranges from presentations at professional conferences to articles from semi-popular science magazines and even an after-dinner talk presented to an amateur astronomy group. Although Rubin writes very clearly, many of these papers are fairly technical and would be challenging for the general reader.

Tools of the Trade: Telescopes, a Catalog, and Some Maps covers a wide range of topics from the Hubble Space Telescope to how Andrew Carnegie and George Ellery Hale established Mt. Wilson Observatory with its giant (by 1910 standards) 100-inch (250-cm) telescope. Rubin's broad knowledge of astronomical history emerges throughout the book and helps to set the background for many of her topics. My favorite essay is the beautifully written "Letter from Chile" describing an observing trip in 1971 to Cerro Tololo Inter-American Observatory. For those of us who have observed there, the letter brings back a flood of pleasant memories, but anyone will enjoy Rubin's description of the Chilean countryside and the spectacular view of the Milky Way from a dark site high in the Andes Mountains.

Matter and Motion contains papers mainly from scientific meetings on the overall theme of the distribution of matter and evidence that most of it is unseen. Included is Rubin's 1995 Russell Lecture (representing the highest award of the American Astronomical Society), a wonderfully clear historical account of what we have learned over the past hundred years about galaxies by examining their spectra and what mysteries are yet to be solved.

*Bright Galaxies, Dark Matter* culminates with a very personal look at the author's life as an astronomer. She includes a few brief biographies of scientists who have influenced her, an interview done for *Mercury* magazine about her "unconventional career," and several vignettes about women in science and the difficulties they face.

Each section of the book is preceded by a brief account of when and where the essays were presented. I found myself continually referring back to these introductions and wished the accounts had been placed with the individual essays. A summary of our understanding of the problem at the time when each essay was written might have been particularly valuable to a general reader. Placing the technical essays in chronological order would also have been helpful.

This collection of essays enables one to follow the evolution of Rubin's ideas about dark matter as the observational evidence mounts. Her presentation of the historical background, often overlooked by other writers, is particularly enlightening. Overall, this is a rich and varied book in which Rubin's love of astronomy and the natural world shines brightly.

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