mentally draining, the only bright spot being Hodgkin's marriage, to Peyton Rous's daughter Marion.

The postwar years bring houses, four children, friends, holidays, and the classical research discoveries. Shortages of equipment and funds and rationing of food and fuel are gradually relieved. Vegetables in France, Renaissance paintings in Italy, and chances to relax on remote British isles are savored. The Physiological Laboratory under Lord Adrian finally hires its first secretary, and grant support is assembled. Collaborations with Katz, Huxley, Keynes, Baker, and visitors lead to the sodium theory, the Hodgkin-Huxley model, longpore theory, ionic and metabolic requirements of the sodium pump, resting and action potentials of muscle, perfusion of axons, and—a trip to Stockholm.

This book is a gentle glimpse of an earlier English scientific era that required independence and saw great discoveries made with small and frugal methods. It gives unexpected insights into the more private thinking and experiences of a scientific giant.

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Astronomical Objects

Variability of Blazars. ESKO VALTAOJA and MAURI VALTONEN, Eds. Cambridge University Press, New York, 1992. xiv, 465 pp., illus. $59.95. From a conference, Jan. 1991.

Astronomers like to give colorful names to newly discovered, or thought to be newly discovered, unusual phenomena. The term "blazar" was coined by Edward Spiegel during a memorable after-dinner speech at the 1978 "Pittsburgh Conference on BL Lac Objects." BL Lac objects are named after their prototype "BL Lacertae," which is one of a class of galactic stars known as Lacertids. However, after such objects were identified with a rapidly varying radio source in 1968, it was realized that BL Lacertae itself was a distant galaxy, not a galactic star. The name "BL Lac object" is now applied to the general class of extragalactic objects that are similar to quasars but are characterized by rapid variability, high polarization of optical and radio emission, and the absence or near absence of the strong optical-emission lines that characterize quasars.

Related to blazars and BL Lac objects are objects variously called active galactic nuclei, highly polarized quasars, or optically violent variables and commonly referred to as AGNs, HPQs, and OVVs, respectively. Often, as the name implies, the term "blazar" is used to describe the most luminous BL Lacs, although as a class BL Lacs are less luminous than quasars and not all blazars are BL Lacs.

Many of the properties that were originally used to define the class of objects called BL Lacs, such as the absence of emission lines, are not always found in objects that are included in papers and conferences on BL Lac objects, and indeed there is little agreement now on just what defines a BL Lac object or blazar.

Variability of Blazars is the proceedings of an international conference of the same title held in the Baltic coastal city of Turku, Finland, at which more than 60 astronomers gathered to present new data and to discuss their theoretical implications. The volume contains 61 papers that vary in length and depth of discussion.

As reflected by the topics of a number of contributions, the central problem of blazars and related objects has been to understand how such prodigious amounts of energy can be radiated from such small volumes in the nuclei of galaxies. The most widely discussed model involves highly anisotropic radiation, at least at radio but probably also at optical and x-ray wavelengths. The anisotropy is thought to result from focusing along the direction of motion by a relativistically moving plasma. It is argued that the observed differences in properties of blazars, AGNs, quasars, BL Lacs, HPQs, and OVVs depend more on the viewing angle than on differences in their intrinsic properties. When viewed along the direction of motion, the galactic nucleus appears unusually bright and is referred to as an AGN, BL Lac, quasar, or blazar.

One consequence of the bulk relativistic motion is so-called "superluminal motion." When a radiating source is moving at velocities near the velocity of light along a direction close to the line of sight, the source nearly catches up with its own radiation. As a result the differential time scale for a distant observer is compressed, giving the illusion of motion that can exceed the velocity of light.

When examined in sufficient detail nearly all blazar radio sources show superluminal motion, so bulk relativistic motion must be common. Indeed it is too common, since only about 1 percent of relativistic beams are expected to be sufficiently aligned to show enhanced radiation and superluminal motion. The outstanding problems are to identify the much more common (unbeamed) parent object and the

Vignettes: Clothing and Unclothing

The corporate style of dress can be quite formal. I made a trip with some university executives one day to the corporate headquarters of a large consumer appliance firm. Every executive in the room was wearing a dark navy pinstriped suit, a gleaming white starched shirt, a conservative silk rep tie, and highly polished black shoes. Our vice-president for research had on a soft brown tweed suit and brown shoes . . . . But at least we were wearing suits. Then the corporate people all took off their jackets and worked in their shirtsleeves during the meeting. We academics kept our jackets on.

—*Dorin Schumacher*, in *Get Funded! A Practical Guide for Scholars Seeking Research Support from Business* (Sage Publications)

There was a well known Cambridge physicist called Dr. G F Searle, who ran the practical classes for undergraduates during the famous Rutherford era. . . . I felt thankful that I had not had to start my physics studies under him—particularly as he had a reputation for being prejudiced against women students. He is said to have come up to an unfortunate female in one of his practical classes and to have said, aggressively: "Are you wearing corsets? You cannot work in a physics lab, with its magnetic instruments, if you are wearing steel-boned corsets. Go and take them off."

—*Joan Freeman*, in *A Passion for Physics: The Story of a Woman Physicist* (Hilger)

nature of the so-called central engine, which supplies the energy needed to accelerate beams of particles to relativistic velocities.

One of the most exciting discoveries in recent years was reported in the paper by Krichbaum *et al.*, who detected radio emission from several quasars and blazars that appear to vary in strength by some 10 percent on the surprisingly short time scale of only a few hours. The reality of the rapid variations was convincingly demonstrated by simultaneous observations, made with the 100-meter radio telescope in Germany and the Very Large Array telescope in New Mexico, with remarkable agreement to a fraction of a percent.

If the variations are intrinsic to the source, simple light travel time arguments suggest that the dimensions of the radiating region are incredibly small, less than a few light hours across. Even allowing for the effects of relativistic time dilation, the apparent size of the radiating region is too small to account for the high radio luminosity by the same synchrotron radiation process generally believed responsible for the radio emission from galaxies and quasars.

Attempts to interpret the observed variations as an extrinsic effect of the intervening medium are attractive because they avoid embarrassing theoretical problems. One idea is that the rapid variability is due to gravitational microlensing by stars located in intervening galaxies. However, the observed variations are wavelength-dependent, whereas gravitational effects should be achromatic. According to the discovery team, refractive interstellar scintillation from propagation effects in the interstellar medium "is a more plausible cause of the rapid radio variations" that they observed. However, in one of the most extreme examples, the radio variations are accompanied by rapid optical variations that appear to be correlated with them and clearly cannot be due to propagation effects through the ionized interstellar medium. Further observational and theoretical studies of intraday variability of blazars are expected to give a wealth of information about the physical conditions in the nuclei of galaxies and about particle acceleration mechanisms. If the correlation between intraday radio and optical variability of blazars is confirmed and extended to other objects, astronomers will be forced to interpret the variability in terms of an intrinsic phenomena, presenting new challenges to their interpretation.

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