Book Reviews

Supernova Remnants

Supernova Remnants and Their X-Ray Emission. JOHN DANZIGER and PAUL GORENSTEIN, Eds. Reidel, Boston, 1983 (distributor, Kluwer Boston, Hingham, Mass.). xviii, 614 pp., illus. $72; paper, $38. International Astronomical Union Symposium No. 101. From a symposium, Venice, Aug. 1982.

The Einstein x-ray satellite has made substantial contributions to virtually every branch of astronomy in a lifetime of only three years. Some of the most fruitful subjects for the satellite's manifold capabilities have been supernova remnants, dramatic in high-resolution images and after solar flares the best subjects for detailed spectral study. Most of us have seen highlights from the first flood of Einstein's results: the impressive maps of Cassiopeia A, spectacular x-ray spectra of Puppis A, the large catalogue of remnants in the Magellanic Clouds. As workers in the field settled down to digest these results, a timely International Astronomical Union symposium was held. The proceedings of this symposium contain a remarkably complete report on the effects of x-ray information on our ideas about supernova remnants. The meeting occurred early enough to be full of the excitement of new results and ideas, yet late enough that most of the Einstein data were in, so that knowledge of the subject as summarized in the proceedings is not likely to change much until the launching of a next-generation x-ray observatory such as AXAF.

The conference organizers wisely included reviews of radio, optical, and theoretical results, so that the x-ray results could be seen in context. However, the x-rays take center stage. We are presented with good high-resolution images (a few of them still not published elsewhere) of Tycho, Cassiopeia A, the Crab, the Cygnus Loop, IC443, and other, less well-known remnants. Spectra from the Solid State Spectrometer and Focal Plane Crystal Spectrometer appear for the Crab, Cassiopeia A, SN1006, Kepler, Tycho, Puppis A, and N132D. Many of these have appeared in the literature, but here the data analysis is refined, and it is useful to have the spectra all in one place.

The growing conviction that nonequilibrium ionization conditions hold in the 10^6 to 10^8K x-ray–emitting plasmas is documented in detail; several groups report theoretical work on modeling such spectra. The chemical abundances derived from x-ray spectra are sensitive to the presence or absence of ionization equilibrium. The important results are that, though early inferences of very high enhancements (relative to solar abundances) of calcium and sulfur in Tycho's remnant, for instance, are much tempered by including time-dependent ionization, abundance anomalies persist. There is still a great deal we do not understand about the x-ray spectra of young remnants.

Danziger, one of the editors of the proceedings, provides a good review of optical properties of remnants, listing in particular those with strong abundance anomalies such as the oxygen-rich knots of Cassiopeia A. A number of other papers present optical spectra of remnants, and several groups contribute theoretical models of optical emission in shocks. D'Odorico and Dopita review the use of optical observations of remnants in other galaxies as indicators of those galaxies' chemical abundances.

A few new radio images appear, notably the Cambridge 3″ resolution map of Tycho by Green and Gull. Dickel's review of radio observations suffers from a lack of illustrations that presumably accompanied the talk, but otherwise surveys the subject adequately. Strom gives a fine summary of proper-motion observations, in radio and optical, of young remnants. Weiler's excellent review of filled-center or Crablike remnants includes a detailed object-by-object discussion and radio maps of all objects and should remain an important starting point for studies of these odd objects for some time to come. Notable theoretical contributions include McKee's discussion of the effects of an inhomogeneous interstellar medium on the evolution of remnants, effects that may help explain anomalous observational results presented in papers by Long and others on statistical properties of remnants in the Large Magellanic Clouds. Cox ably summarizes the physics of heating of the interstellar medium by supernova remnants, and Chevalier discusses new results on the interaction of remnants with surrounding material having different density profiles, results confirmed by numerical hydrodynamic calculations presented in papers by several groups.

The volume contains transcriptions of some of the discussions that followed the papers. The transcripts are useful guides to the reception of the papers, and even occasionally contain quantitative information. Indexes of both subjects and objects have been attempted. The former is quite incomplete, but it is rare to find even an attempt in a conference proceedings. Both are useful additions, in any case.

To whom can this volume be recommended? Certainly to any workers in the field; the scope of the material is such that few researchers would command all of the information here. A graduate student with some basic knowledge of remnants and wishing to specialize will find the compilation quite valuable. I venture to predict that it will remain useful rather longer than the typical conference proceedings, even though it did not appear until over a year from the date of the symposium; the state of the field, and the quality and generality of many of the contributions, should ensure this.

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Hot Atoms

Fundamental Processes in Energetic Atomic Collisions. H. O. LUTZ, J. S. BRIGGS, and H. KLEINPOPPEN, Eds. Plenum, New York, 1983. xii, 675 pp., illus. $95. NATO Advanced Science Institutes Series B, vol. 103. From an institute, Maratea, Italy, Sept. 1982.

Atomic physics research is primarily concerned with the deeper understanding of nature in the atomic environment. Since the fundamental interactions are well known, the challenge to atomic physicists is to apply the basic tool of quantum mechanics to gain a knowledge of the structure of atoms and the underlying energy transfer pathways between the collisions of atoms with other atoms and with electrons, positrons, and photons.

In the past 25 years there have been significant advances in the understanding of atoms and atomic collisions as new experimental techniques (for example, accelerators and synchrotron radiations) have become available and as demand