There are many significant dissimilarities between a mind and a dictionary: a dictionary, unlike a mind, contains only definitions of words, is open to public scrutiny and so on. How are we to construct a scientist's (private) dictionary from his public statements when the latter are often shaped for the audience for which they are intended? Given these and similar queries it is unfortunate that Bellone did not discuss this theory in much greater detail.

Bellone's notion of the scientist's dictionary has a further consequence for his historical claim that a revolution occurred in physics in the late eighteenth and early nineteenth centuries. Revolutions have, as Kuhn insisted, a social component which he expressed in terms of paradigm change being a change in consensus among the members of a scientific *community*. Even if one does not agree with the details of Kuhn's thesis it would appear difficult for the historian interested in large-scale changes in science to omit this social dimension. Yet this is precisely what Bellone does. According to his theory, each scientist maintains his own dictionary and yet Bellone offers the historian no means of moving from individual dictionaries to an understanding of broader historical processes. Indeed, his failure to appreciate the latter leaves the reader unclear as to what constituted the "second scientific revolution".

Unfortunately, the author conveys the impression that he is divorced from the main currents of historical scholarship. An examination of the book's endnotes reveals surprisingly few references to the major secondary works on the subjects he discusses. His indiscriminate use of terms such as deduction, crucial experiment, common sense, scientific revolution, mechanism and Newtonianism indicates that he is not aware of the specific meaning conventionally attached to them. Finally, it is surely only ignorance of recent scholarship that could have led the author to construct his book as an attack on Duhem's outmoded thesis. □

*G. N. Cantor is a Lecturer in the Department of Philosophy at the University of Leeds.*

# Across the spectrum of IR astronomy

R.F. Carswell

*Infrared Astronomy.* International Astronomical Union Symposium No. 96. Edited by C.G. Wynn-Williams and D.P. Cruikshank. Pp.376. ISBN hbk 90-277-1277-1; ISBN pbk 90-277-1228-X. (Reidel: 1981.) Hbk Dfl.90, $47.50; pbk Dfl.45, $23.50.

FEW branches of astronomy have made such rapid progress in the past few years as the infrared. With the continuing development of modern detector systems, and in particular the availability of four telescopes high on Mauna Kea in Hawaii above most of the atmospheric absorption, there is every expectation that this will continue. It was therefore appropriate that a symposium on infrared astronomy should be held in Hawaii last year, drawing together contributions from many of the most active people in the field.

The papers included in the proceedings reflect the diversity of topics to which infrared astronomy is making its significant, and often unique, contribution. Articles on planetary studies, protostellar objects, molecular clouds, dust, nebular emission lines, stars in external galaxies, and active galactic nuclei show just how wide the range is. The often dull (to an outside astronomer) technical papers describing detector systems were deliberately excluded from the symposium, and the editors chose to include only reviews on each topic rather than all the inevitable specialist results normally heard at such symposia. The result is a volume which summarizes the present state of the subject well and gives an idea of the rapid advances being made without the non-specialist reader having to wade through a mass of detail.

To choose a few at random, the three descriptions by Evans, Hyland and Thompson highlight the value of infrared studies of the highly obscured regions where star formation is occurring, and provide useful summaries for the relatively ignorant such as myself. The review of the reviews on this topic by Zuckerman helps to give the overall picture. In an area where I have more expertise, Soifer and Neugebauer give us a comprehensive survey of the properties of active galactic nuclei and quasars.

The final summary by Longair states succinctly what emerges from the proceedings in general. Infrared astronomy is proving to be useful in probing an increasingly diverse range of astrophysical questions and, with future developments, such as grating spectrometers, area detectors and infrared astronomy satellites, the trend towards "in depth" studies of particular classes of objects at all wavelengths is likely to continue. Thus, a book on infrared astronomy is likely to give way to more specialist collections. In the meantime, this volume provides a useful, up-to-date review of the entire field. □

*R.F. Carswell is at the Institute of Astronomy, Cambridge.*

# Hot history

P.T. Landsberg

*The Tragicomical History of Thermodynamics 1822–1854. Studies in the History of Mathematics and Physical Sciences,* 4. By C. Truesdell. Pp.372. ISBN 3-540-90403-4. (Springer-Verlag: 1981.) DM99, $58.50.

WHAT is the meaning of the following result: "If the total heat of a homogeneous and uniformly hot substance be conceived to be divided into any number of equal parts, the effects of those parts in causing work to be performed are equal"? If this should not be quite clear, the following may help: "If the absolute temperature of any uniformly hot substance be divided into any number of equal parts, the effect of those parts in causing work to be performed are equal". These are quotes from William John Macquorn Rankine (1820–1872), a Scottish mining engineer, writer on thermodynamics, inventor of the word "adiabatic". They are his version of the second law of thermodynamics as given in his *Manual of the Steam Engine* which saw many editions, starting in 1859. Little wonder, then, that James Clerk Maxwell felt in 1878 that anyone who actually understood these remarks could explain thermodynamically what Tennyson had said of the great Duke:

whose eighty winters froze with one rebuke
All great self-seekers trampling on the right.

If oscillations of this order in the clarity of conceptions concerning thermodynamics could take place *after* the period covered in Truesdell's book, it is perhaps not surprising that the period itself also furnishes many challenges to those who come in today to tidy up the errors of the founding fathers of the subject. This is precisely what Truesdell seeks to do (the above quotations will not be found in this book).

Where Maxwell proceeded with delicacy and humour, Truesdell is hard-hitting, hoping to raise in this way the subject from the "*Dismal Swamp of Obscurity* that from the first it was and that to-day in common instruction it is" (p.6). Leaving an assessment of this provocative remark to the many students and teachers of the subject, the book deals with Truesdell's rediscovery (following J. Moutier) of F. Reech (1805–1884) and has chapters or sections on Carnot, Helmholtz (*The Conservation of Force* being described as his weakest paper), Fourier, Clausius, Rankine, Kelvin and many others, mathematical aspects being given prominence.

The teaching of the subject can conveniently start with the introduction of specific and latent heat functions $C$ and $l$ defined in a usual notation by:

$$dQ = C_v\,dT + l_v\,dV = C_p\,dT + l_p\,dp.$$

To these relations a third relation may be