Turning over pebbles

David Lindley

Lonely Hearts of the Cosmos. By Dennis Overbye. Macmillan: 1991. Pp. 438. £17.50, \$25.

OBSERVATIONAL cosmology is a fight over a factor of two. Hubble's constant, which relates a galaxy's redshift to its distance and therefore specifies how fast the Universe is expanding, is generally agreed to be no more than 100 kilometres per second per megaparsec, and no less than 50. In principle, figuring out where in that range it truly lies demands no more than the usual sort of stubbornness that any experimental science requires: galaxy redshifts are easy to measure, but estimating cosmological distances, by some independent means, is enormously difficult. Usually, the astronomer tries to find some proxy for the distance, such as the apparent brightness of an object whose intrinsic luminosity is known, but that brings in all kinds of complications. Is it safe to assume that the brightest hydrogen cloud in a distant galaxy or the brightest galaxy in a distant cluster are about as bright as the same objects in our own cosmic neighbourhood?

The search for the true value of Hubble's constant is not, therefore, a crazy race of the sort that particle physicists indulge in, when he who gets the most money and builds the biggest machine most quickly wins the prize, but a patient acquisition of data followed by minute efforts to tease out every possible source of bias and contamination. It attracts scientists of a certain mentality, people whose wish to know the design of nature is coupled with a willingness to turn over every pebble on the beach in the search. Such a person is Allan Sandage, the veteran astronomer who is the Levin (the blurb suggests King Lear, but that seems a bit too grand) of Dennis Overbye's saga of modern cosmology, *Lonely Hearts of the Cosmos*. Sandage evidently decided at an early age that his lot was to take over not merely the duties of his mentor, Edwin Hubble, but some version of his soul: in Sandage's world, there can be no cosmologist with more

burdensome a task, more seriousness of purpose, more freedom from frivolity, than Sandage.

All this would be wildly overblown if we were talking about a scientific effort to measure, for example, the energy-level structure of some complex atomic nucleus. Considered as a scientific job, measuring Hubble's constant is not significantly different from measuring anything else, but the fact that the outcome of the measurement tells us whether the Universe will expand for ever or one day collapse gives the research a certain weightiness, and makes it easier for the scientists involved to fall prey to arthurian delusions.

Most cosmologists, fortunately, stay relatively free of these over-romantic influences and, as Overbye ably recounts, spend their time as do modern scientists in general — holding raucous conferences in sunny locations (or wintry, for the skiing), and yelling at each other during seminars. Some readers of this book might find themselves put off by the author's frequent intrusions into the narrative, bumping about the Arizona desert in a jeep or frisbeeing on Hawaiian sands, but underneath this 'you-are-there' reportage, which seems to be a requirement for anything calling itself popular science these days, there is a shrewd and purposefully told tale. Few books mix the personal with the scientific, the narrative with the pedagogy, so tidily as this. And Overbye is by no means overawed by his subject — either the science or the people. The advantage of his spending some years as a sort of guest on the cosmological conference circuit is that he sees the characters not only as a collection of hard-working and creative scientists, but on occasions as quacks and peddlers of snake-oil. Astrophysicists, as Lev Landau is supposed to have said, are frequently wrong but never in doubt. Nor is Overbye overwhelmed by the wonders of modern cosmological theorizing — he seems in the end to side more with the observers, becoming dismayed and frustrated by the ease with which the theorists complicate the Universe a bit more to escape the latest observational constraint.

By the end of the tale, Sandage (who is the book's subject at least as much as modern cosmology) has been transformed by Overbye's close observation from a determined, if obsessive and over serious youth, into a much more ambiguous character. Ironically, for someone who set out to show that only by unceasing effort and painstaking work could the Universe be measured, Sandage in his later years seems to have followed many a great scientist in coming to believe that his experience and knowledge supply him with his own personal path to the truth, as if he had acquired a sixth sense by which he could distinguish good data from bad, and right answers from wrong. If Overbye wanted an epigraph for his splendid book, it could simply be: lighten up a little, Allan! □

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Solutions to solvation

Arthur Covington

Thermodynamics of Solvation: Solution and Dissolution. Ions and Solvents. Structure and Energetics. By G. A. Krestov. Horwood: 1991. Pp. 284. £48.

"SOLVATION should be considered as the sum of energetic and structural changes occurring in a system in the process of transferring gaseous ions (or other atomic-molecular particles) into liquid solvent, resulting in the formation of a homogeneous solution having a fixed chemical composition and structure," is the definition given by G. A. Krestov. He goes on to point out that the essential feature of solvation is a pictorial one of bonding of the solvent in the immediate vicinity of an ion forming a solvation shell. Problems arise in trying to determine the thickness of the shell and how many molecules it contains — the solvation number.

The information that thermodynamics can provide is limited by the fact that neutral combinations of ions have to be studied and that separating these into ionic contributions depends on arbitrary assumptions (conventions) or nonthermodynamic measurements; also, deriving structural information from these quantities is conjectural. Spectroscopic methods over the past 20 years have provided much more useful information on these points. Methods such as neutron and X-ray scattering and Raman and NMR spectroscopy are outside the author's remit and receive only brief mention. Neither do we find any details of the experimental methods used to provide the thermodynamic information. But there are many useful tabular data on the properties of ions and solvents as well as the expected free energies, enthalpies and entropies. There are also some unfamiliar quantities to intrigue — potential enthalpy, enthalpy capacity and isobaric-isothermic potential.

The translation editor, John Burgess of Leicester University, who has also written for the same publisher on this subject (*Metal Ions in Solution*, 1978), has done a good job on the Russian text, which dates from about 1982, although I detected some trivial errors — for example, in names (Hidman for Hindman, Solomon for Salomon). The expert will find in this book a good introduction to Russian work and thinking in this area; others will need to read Burgess's book first, or one of several alternatives, for the text is long on statements but short on explanations. I cannot agree with the publisher's flyleaf that this is a book for senior undergraduates or even for postgraduates. □

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