

Joseph's abiding curiosity about the relations between heat and mechanical work.

Clearly, it is hard to know just how far-seeing these wider reflexions were. Unlike his better-educated brother, Joseph was a doer, a self-taught inventor, rather than a *savant*. But it seems likely that from the 1780s until his death in 1810, he groped some way towards the notion that heat and work are interchangeable. This, at all events, was the retrospective view of the engineer Marc Seguin, a great-nephew of the Montgolfiers who, as a child, had known and learned from Joseph. Gillispie's careful re-examination of the evidence suggests that Joseph's ideas probably originated in his work on an ingenious heat-pump, a device that raised water by means of the heat produced in the rapid explosion of hydrogen or the burning of faggots. Thereafter, it survived through

a series of related inventions of which at least one, the hydraulic ram, was favourably viewed by the leading scientists of the capital. I find the historical significance of this work as intriguing as Gillispie obviously does, though it throws up tantalizing possibilities rather than a justification for a major reinterpretation of the prehistory of thermodynamics.

Despite the loose ends, it is hard to imagine that there is very much more to be said on the Montgolfiers and their world. However, quite apart from its scholarly merits, the book can be recommended as a good read. The work of any historian has its drab moments, but the wit and liveliness of Gillispie's text suggest that in this case such moments were few and far between. □

*Robert Fox teaches the history of science at the University of Lancaster. At present, he holds a British Academy Readership in the Humanities.*

## Megalithic points

Clive Ruggles

### **Echoes of the Ancient Skies: The Astronomy of Lost Civilizations.**

By E.C. Krupp.

Harper and Row: 1983. Pp.386. £16.95.

POPULAR books on archaeoastronomy continue to issue forth from the presses once a year or so, although the emphasis has changed distinctly since the 'Stonehenge Decoded' debate of the 1960's which started it all, and again since the more recent controversies over Alexander Thom's theories on megalithic 'science'. The current message is that astronomy is a sacred rather than a 'scientific' activity; and that in studying archaeoastronomy we are exploring the belief systems, ceremonial activities and cosmologies of diverse societies past (here we now include the great literate civilizations) and present (in this case, for 'archaeoastronomy' read 'ethnoastronomy').

The subject matter of Krupp's book (excluding what amounts to a rather incongruous swift potted history of cosmology in the final chapter in order, apparently, merely to make a concluding point about "why we do it") reflects a change in the definition of archaeoastronomy which is all to the good; archaeoastronomy is beginning to find its feet as a respectable branch of archaeology and ethnography. There is talk of how rituals serve to demarcate and regulate time periods (hardly a new point to anthropologists, admittedly) and hence tend to be related to astronomical observations; and of how the extent of astronomical practice can relate to a society's complexity. It is good to see such points stressed at intervals throughout *Echoes of the Ancient Skies*, and illustrated with a variety of examples.

Yet I feel, such success has been achieved

in the face of, rather than owing to, the thematic way in which the material has been organized. The Maya civilization (to take an extreme example) crops up in no less than six different chapters and might arguably have appeared in one or two more. On the other hand, in the 'Skies we Watch' chapter we are taken in the short space of 40 pages from ancient Egypt to Shang dynasty China, thence to Babylon, pre-conquest Illinois, prehistoric Scotland and Brittany, the Inca in Peru, the Maya in Mexico, and finally back to ancient China.

All this leaves the reader breathless if not a little confused and at times, as one apparently unrelated description follows another, perhaps even slightly bored; this despite Krupp's enthusiasm and readable style, and the originality and excitement of much of the subject matter. Attempts to draw threads together are too few and far between, and I wonder if, in the end, archaeoastronomy doesn't come over to the average reader primarily as the mere documentation of astronomical practice.

Krupp has to some extent played down controversy in order to present the evidence for ritual astronomy as a coherent whole. This is defensible for a popular book, but care is needed that a new popular bandwagon (albeit less fantastic than previous ones) does not start rolling.

Already ideas of ritual astronomy are running well ahead of the evidence in some areas, notably the megaliths (where serious debate continues, on the basis of extensive new site surveys and new methodology, about the precision and often the very existence of significant astronomical alignments). I feel that Krupp might have emphasized these areas: by doing so his book would have been truer to the spirit of much current serious archaeoastronomical research, and might have attracted a more discerning readership. □

*Clive Ruggles is a Research Fellow in the Department of Mathematics at the University of Leicester.*

## Falling apples and leaning towers

John D. Barrow

### **Frame of the Universe:**

**A History of Physical Cosmology.**

By Frank Durham and

Robert O. Purrington.

Columbia University Press: 1983.

Pp.275. \$32.50, £22.

'HISTORY repeats itself; historians repeat each other'; the natural reaction perhaps of someone seeing another medium-brow guide to the history of science. A sufficient number of such surveys already exist to create a form of '1066 and all that' sub-culture within the subject. Those events that never happened live most vividly in the mind and are much more memorable than those that really did: Newton's falling apple; Archimedes' bath, Galileo and the tower of Pisa — all are cornerstones of the sub-culture.

The authors of the 'Frame of the Universe' have chosen to follow the history of cosmological ideas from ancient to modern times at a level suitable for non-specialist college courses and general reading. They claim no great novelty in their treatment and erect their frame around the first ancient and Greek astronomers, the Medievals, Copernicus, Galileo and Newton, before moving on to Einstein, modern big bang cosmology and gravitational collapse. Yet, the clarity of presentation and the engaging style of the authors make this an enjoyable book for any scientist to read. Those wishing to pursue subjects in greater depth are provided with an excellent bibliography and detailed notes.

One of the problems with histories of this sort is that our own categories of thought so influence the presentation. We view the past solely in terms of the route necessary to reach the (right) answers of the present. The failures are ignored as inessential by-products of a never-faltering march towards the 'truth'. This 'Whig' approach to the history of science is the one that prevails in the minds of most working scientists with a passing interest in the history of their subject and, although the authors are aware of this snare, they do not make any real effort to avoid it. The other weak point in the overall treatment, which will be disappointing to many students reading the book, is that whereas the authors are very lucid in describing the course of events, they are weak on the explanatory side. They rarely ever ask the interesting question 'Why'. Why, for example, did the Jews take no interest in astrology? What role did their religious beliefs play, and so forth.

In the opening chapters there is a particularly clear discussion of various megalithic 'observatories', including Stone-