The Universe as a Whole

P.B. Medawar

The Return to Cosmology: Postmodern Science and the Theology of Nature.

By Stephen Toulmin.

University of California Press: 1983.

Pp.283. £17, \$25.95.

WHEN I was a student the scientists most prominent in the public eye were theoretical physicists with cosmological leanings, men whose views on God and the order of the Universe were eagerly sought and widely attended to.

Whether or not they were the patricians of science they were reputed to be, they had a lot going for them; not the least important characteristic being natural good manners that would have made it unthinkable for them to make pronouncements upon, for example, a supposedly extraterrestrial origin of life. Arthur Eddington, moreover, wrote with a winning charm that has not been surpassed in popular scientific writing and Sir James Jeans had the courage to think big — to think about God and about the relevance to the garden as a whole of the patch of ground he himself cultivated. They had philosophic opinions too ("the stuff of the world is mind-stuff" declared one of them).

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Their principal weakness was to be hopelessly inexpert as philosophers: Eddington's epistemology was a pain and both he and Jeans were thought to have deserved the sharp repudiation of their opinions by Professor L. Susan Stebbing in her *Philosophy and the Physicists*.

Stephen Toulmin raises here anew that which might be called "Kant's problem":

Is "the Universe as a Whole," so considered, a legitimate topic of rational investigation and speculation, or even a legitimate subject of human language at all? . . . In what respects, and on what conditions, can anything be said about the natural world in its entirety which is not dependent on our ability to subdivide natural phenomena into separate aspects, along disciplinary lines, and discover truths about those aspects one at a time?"

I know no one better qualified to address these problems than Stephen Toulmin, a pupil of Ludwig Wittgenstein's. The way he goes about it is this: a long introductory chapter discusses Kant's problem as a whole ("What kind of things. . . can we learn from the results of the natural sciences which are of cosmological significance today?"). There are some amusing asides in the course of this chapter, in which he recalls his review of Julian Huxley's notion of evolutionary ethics under the title "World-stuff and Nonsense". He comments on Pierre Duhem's dilemma that it arose out of his unwillingness as a physicist to express any opinion conflicting with his personal commitments as a Roman Catholic, and indeed Duhem reserved to religion any right to speak about Reality. Of Teilhard de Chardin he charitably remarks that "his whole charming scheme of 'noosphere,' 'omega point,' and the rest, still strikes me as being a vehicle of wish fulfillment as much as of serious thought".

Before he gets down to cases — to a consideration of individual cosmologists — Toulmin gives us an especially interesting and well-thought-out chapter on scientific theories and scientific myths. No one need fear that a man as sensible as Toulmin is going to propound the view heard sometimes from anthropologists that myths and scientific theories are alternative explanations for the world of the same stature, though one of them, myth, is emancipated from the bondage of a commitment to empirical truth. In my opinion, to compare science with myth is to compare the wrong genres: it is not myth and science but myth and imaginative literature that go together, for what are most myths but science fiction of forgotten origins? This is not quite the view of Stephen Toulmin, who makes a case for saying that mythical constructions may enter into professedly scientific theories to gratify the personal predilections of scientists to fulfil various non-scientific motives. Laymen will often be unaware that scientists are playing these tricks on them, because the habit of consulting scientists upon scientific problems to which they often have the answers tends

to invest scientists with a sacerdotal aura — with the effect that laymen look to scientists for authoritative opinions on matters on which they are entitled no more than private opinions.

The later part of Toulmin's book is devoted to a consideration of individual cosmologists — in particular of Arthur Koestler, Pierre Teilhard de Chardin, Jacques Monod, François Jacob, Carl Sagan and Gregory Bateson. The essays here are critical, to be sure, but they are unfailingly generous and well-mannered, so anyone on the lookout for good old-fashioned knocking copy will be disappointed. I should like to quote the opening paragraphs of Toulmin's piece on Koestler because they illustrate better than any other passages Toulmin's style of thinking and writing:

This is a bad time for polymaths. The old jibe about a Jack-of-all-trades being master of none has bitten deep into our minds, so that few people will admit to an intellectual grasp of anything more than a narrow range of experience. In a fragmented culture, everybody is *expected* to be a specialist: so men cling to the professional standards of their guilds as the lifebelts which will keep them afloat on a sea of general ideas which they have lost the capacity either to swim in or to plumb. . . . Natural scientists, again, look with suspicion at those colleagues who stray too far outside their specialisms, and for the most part they shut their eyes to the very existence of philosophy. In return, the philosophers have made their craft a 'profession' of its own: a professional philosopher no longer needs to understand even the broadest ideas of contemporary natural science — to say nothing of its factual discoveries.

Toulmin and I in our writings have covered much the same ground and not unexpectedly I don't always agree with him. I don't agree with Toulmin's generous appraisal of Arthur Koestler because I was more oppressed than Toulmin was by the element of "quackery" and show-offery for which Toulmin soundly castigates Koestler on p.139. Koestler had also a deep-seated lack of humility — made apparent by his campaign of propaganda (fortunately fruitless) against legislation that requires pets that might import rabies into the country to go through a period of quarantine before admission.

The best of Stephen Toulmin's very good writing is on Teilhard de Chardin, on Jacques Monod and — the deeper thinker in Toulmin's view — on François Jacob. Although he is sometimes sharply critical, particularly of Monod, he comes sometimes to the defence of the subject of his criticism — a defence justified by his perceptive understanding of the French cultural tradition, especially the element of exaggeration and the theatrical in French cultural dialogue. *Les anglophones*, he tells us, may easily be mistaken to "read their debating points as assertions, their exaggerations as dogmas, and their oratory as rigorous proof".

Writing of the eighteenth century, Toulmin comments:

If we are puzzled by the shelves of collected sermons in our ancestors' libraries, that is because we forget how far scientific and aesthetic questions have replaced moral and theological ones as the staple of dinner-table-talk; and how far the popular scientists has won over the audience of the popular preacher.

In Johnson's day conversation turned easily and naturally to ethics, philosophy or theology, and acquaintance with the writings of Andrew Baxter and Bishop Wolverton was taken for granted. Toulmin deplores as I do the change of fashion to-day that has withdrawn these topics from the dialogue and serious reading of so many educated people; to be sure it would

cast a pall over almost any modern dinner party if a hostess were to start the conversation at dinner by turning to her principal guest and saying "Pray, Sir Alfred, what is your conception of the notion of convenient Grace?"

This change of manners will unhappily deny Toulmin's book the readership that his book richly deserves because it is authoritative, especially well written and immensely readable. □

Sir Peter Medawar is a member of the Scientific Staff of the Medical Research Council's Clinical Research Centre, Harrow, Middlesex.

Maturing astronomy

G.T. Bath

Cosmology and Astrophysics: Essays in Honor of Thomas Gold.

Edited by Yervant Terzian and Elizabeth M. Bilson.

Cornell University Press: 1983. Pp. 163. £19, \$29.95.

"THAT Trinity of angry young astronomers of the fifties", was the way I always thought of them — Bondi, Gold and Hoyle. A trio of *enfants terribles* raging around the ivory towers of Cambridge, upsetting the established order of things, and putting God in his place by advocating a better way of ordering the Universe than He had been smart enough to dream of.

Of the three, Hoyle was the most articulate and arresting to the general public. Bondi was the distant mathematical genius with the strong foreign accent, the professor out of Tintin comics. Gold was the force in the background, thoughtful and taking great care to be patiently logical in his explanations of the way things ought to be on the basis — the only acceptable basis — of straightforward physical reasoning. Now, 35 years after the birth of steady state cosmology, the angry young men have become grand old ones. And we give them our honours.

This book contains essays in honour of Tommy Gold, celebrating his sixtieth birthday and covering the three main fields his sparkling mind has contributed to — cosmology, pulsar models and Solar System physics. They are written by past collaborators, including Hoyle and Bondi, and scientists of a younger generation who have been inspired by his person and by his ideas. That inspiration comes through clearly in articles by former students like Peter Goldreich — inspiration derived from outspoken courage and innovative cussedness. A succinct image is provided by Goldreich: "In 1963, I was a medal winner at the NCAA judo championships. Shortly thereafter, Tommy expressed doubt about the efficiency of judo. We

were standing in the kitchen at the time and I strangled him on the spot".

The first half of the book contains articles by Hoyle and Bondi on steady state cosmology, with a short historical memoir from Gold. The origins of steady state cosmology in 1948 make fascinating reading. It becomes clear how the development of different facets of the theory depended, in practice, on the interplay of personalities around the key concept of the Perfect Cosmological Principle, throwing out conservation of matter and energy with gay abandon, or modifying Einstein's equations to create a reservoir of available energy. The differences between the original ideas of Bondi and Gold on the one hand and of Hoyle on the other are made clear.

Hermann Bondi's contribution consists of a lucid exposition of the need for a general theory of relativity using the sort of gedanken experiment with which a scientist in command of his subject can explain the most abstruse and intuitively paradoxical aspects of physical law. Using chains, mirrors, buckets and cylinders, Bondi builds before our eyes the gravitational red-shift and Einstein's theory of gravitation, with illuminating asides as the façade rises. Hoyle's contribution attempts to resuscitate the cadaverous remains of steady state

cosmology. The greatest contribution of steady state cosmology, and, in part, of Hoyle's greater work on stellar structure and nucleosynthesis, was to inspire whole generations of younger astrophysicists. What greater contribution is there? It is their view which cosmology now reflects, with its close links with elementary particle physics, grand unified field theory and quantum gravity. It would sadly seem that Sir Fred has not been noticing.

Dennis Sciama contributes a piece on black hole explosions which amply illustrates the state of mental excitement and joy that comes from the appreciation of new unities within the body of physics — connections between apparently distant limbs which, when recognized, can act to open up fresh channels of understanding. Of all the contributions to the book, I most enjoyed the short, sharp chapter by Joseph Taylor describing the present state of the field which he has done so much to create, the binary pulsars. The description is a classic of succinct, objective reporting, ending with a flourish which would have caused many a raised eyebrow in the not-too-distant past: "We take this agreement" (between the predicted and observed period decrease of the binary pulsar PSR 1913+16) "as compelling evidence for the existence of gravitational waves".

The book ends with a discussion of theories of the Solar System, some of which are still controversial while others have become accepted in the established body of planetary science.

The mixture of heresy and established physics, iconoclasm and accepted orthodoxy reflects Gold's own contribution to science. Tommy Gold, for all his gadfly ways, knows one element which is essential in good science. Old men's theories must satisfy the critical appraisal of the coming generation. Otherwise they will suffer the wrath of angry young men. □

G.T. Bath is a Research Fellow of Wolfson College, University of Oxford.

"That Trinity of angry young astronomers of the fifties" — Thomas Gold, Herman Bondi and Fred Hoyle at a conference in Berkeley in 1961.