observed burst frequency, decreasing N . But in fact, say Fenimore *et al.*, the present inconsistency cannot be explained by these effects alone.

To arrive at this conclusion, the authors have had to combine two sets of data. Although BATSE is detecting the numerous weaker bursts, it has not been in operation long enough to detect many of the rarer, strong events to complete the $\log N - \log P$ curve at the high- P end. This gap is filled by the data from a small instrument on Pioneer Venus Orbiter which has been in operation for over a decade. (In fact, because the Pioneer experiment views practically the entire sky, whereas BATSE's view is always obscured by Earth, the two databases may never be equal for strong events, although they may come close.) The two experiments do not cover the same energy range and have very different sensitivities, so combining the two curves is a contentious business. But even with the uncertainties inherent in the method, the two curves apparently

cannot be reconciled.

So where does the answer lie? Before assuming that γ -ray bursters are cosmological, two other possibilities can be considered. The sources could be spherically distributed around the Sun's locality in the Galaxy and still fit the statistical results, but there are few ideas currently about what might generate γ -ray bursts in our cosmic backyard. Stepping back farther, a distribution about the galactic halo would be consistent with the statistics and possibly with the neutron-star hypothesis⁵, but unlike other known halo distributions, the burster distribution would have to have a minimum core radius of 18 kiloparsecs (on the galactic outskirts) for it not to produce an excess of sources towards the Galactic Centre⁶.

But if the bursters are cosmological, one possibility suggested by Piran⁷ is that they are the product of merging neutron stars in binary systems in galaxies at redshifts of around 1, whose radiation has travelled 20 billion light years.

This would preserve the idea that they come from compact objects and would give the requisite N and P providing that cosmological evolution has changed the merging population. The conclusion of Fenimore *et al.* is similar: that whatever the sources are, if they are beyond our Galaxy, then cosmological evolution has decreased their number or strength. It certainly seems, however, that the answer to this quandary, like the bursters themselves, may be further away than we thought. □

Kevin Hurley is at the Space Sciences Laboratory, University of California, Berkeley, California 94720, USA.

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OBITUARY

Isaac Asimov (1920–1992)

ISAAC ASIMOV, one of the great explainers of the age, died on 6 April, aged 72.

Born in Russia, just after the revolution, of Jewish parents (although he speculated that the name might be Islamic, meaning son of Hassim, with Uzbek roots), Asimov emigrated with his family to Brooklyn at the age of 3. His early life revolved around his father's candy store, where he taught himself to read with the magazines on the shelves and first encountered science fiction. He received a PhD in chemistry at Columbia, became professor of biochemistry at Boston University Medical School, and was co-author of the text *Biochemistry and Human Metabolism*. But he became world famous for his work in science fiction and the popularization of science.

Like T. H. Huxley, Asimov was motivated by profoundly democratic impulses to communicate science to the public. "Science is too important", he said paraphrasing Clemenceau, "to be left to the scientists." It will never be known how many practising scientists owe their initial inspiration to a book, article or short story by Asimov — nor how many ordinary citizens are sympathetic to the scientific enterprise for the same reason. M. Minsky, one of the pioneers of artificial intelligence, was first motivated by Asimov's robot stories (conceived to illustrate human/robot partnerships and to counter the prevailing notion, going back to *Frankenstein*, of robots as necessarily malign). At a time when science fiction was mainly

devoted to action and adventure, Asimov introduced puzzle-solving themes that taught science and thinking along the way.

A number of his phrases and ideas have insinuated themselves into the culture of science — his description of the Solar System as "four planets plus debris", for example, and his notion of carrying icebergs from the rings of Saturn to the arid wastelands of Mars.

His output was prodigious, approaching 500 volumes, always in his characteristically straightforward and plainspeaking syntax. The Science Fiction Writers of America voted *Nightfall* the best science fiction short story of "all time". He received prizes from the American Chemical Society and the American Association for the Advancement of Science, and over a dozen honorary degrees. His interests were not restricted to science: his legacy includes two-volume guides to Shakespeare and the Bible, and a thick commentary on Byron's *Don Juan*. The *Foundation* series on the decline of a galactic empire was based on a close reading of Gibbon's *Decline and Fall of the Roman Empire*, a principal theme being the effort to keep science alive as the Dark Ages rolled in.

Asimov spoke out in favour of science and reason and against pseudoscience and superstition. He was a founding fellow of the Committee for Scientific Investigation of Claims of the Paranormal, and President of the American Humanist Association. He was not

afraid to criticize the US government and was deeply committed to stabilizing world population growth.

As someone born in poverty, and possessed by a lifelong passion to write and explain, Asimov by his own standards led a successful and happy life. In one of his last books he wrote that "my life has just about run its course and I don't really expect to live much longer". However, he went on, his love for his wife, the psychiatrist Janet Jepson, and hers for him sustaining him. "It's been a good life, and I am satisfied with it. So please don't worry about me."

I don't. Instead, I worry about the rest of us, with no Isaac Asimov around to inspire the young to learning and to science. Carl Sagan

Carl Sagan is at the Laboratory for Planetary Studies, Cornell University, Ithaca, New York 14850, USA.