



## The chemical cosmos – a guided tour

by Steve Miller

Springer, 2011. ISBN 978-1-4419-8443-2.  
Pp xii + 236, £26.99 (pbk).

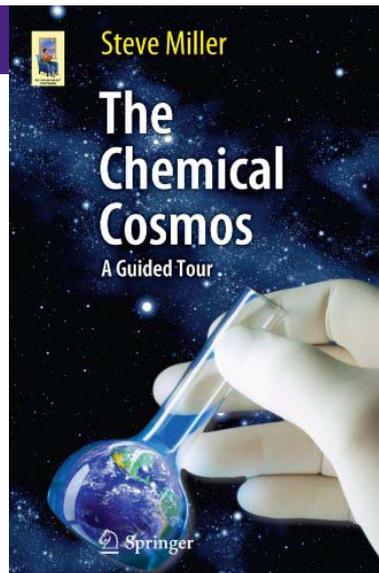
Good books are hard to describe. In some ways, this is more of a package holiday than a guided tour, because the pace is certainly hectic. If I got nothing else from this book, I'd be grateful for the amount of quantum mechanics included, anecdotally and memorably. The history of ionic spectroscopy gets a fair run and left me feeling I now know a bit about it. That brings me to the hero –  $H_3^+$  – a tiny, cocked-hat of a charged molecule. I began to imagine it as a sort of slightly-dodgy, Restoration-comedy character (a friend of MacHeath, perhaps?).

We begin (where else?) shortly after the Big Bang, when the temperature drops enough for a little chemistry. Miller ensures that we understand byways and dead-ends in infrared spectroscopy that led to confirmation of the existence of  $H_3^+$ . He is cheerfully generous in his descriptions of the roles of theoreticians, experimenters and observers. He also has a tal-

ent for illustrated analogies and concedes that though analogies are helpful, they are not the whole story.

So, we follow 'H three plus' as infrared observers lurk on mountain tops and search their complicated spectra of hot clouds like M42 in Orion or the vast, cold clouds that fill some of the dark spaces of the Milky Way. We see the role of  $H_3^+$  in the formation of early stars. It is often cool! It gets rid of the heat and prepares the way for contraction, which is needed to form stars and, later, planets. It still lurks in the atmosphere of Jupiter now.

The climax comes with the discoveries of exoplanets and the struggle to understand how many of them can be both gas giants and close (sometimes alarmingly close) to their stars. The



cool cocked-hat molecule comes into its own, yet again.

Steve Miller is a Professor at UCL and an accomplished speaker at the RAS (no doubt elsewhere as well). He's written a book I'm pleased to recommend for its light touch and humour ('heavy hydrogen hearted') and, above all, for his willingness to explain. After a most enjoyable read, I had quite a bit to think about and there is a useful section of recommended further reading.

**Roger O'Brien**

Roger, an amateur astronomer since 1957, worked in a bank for 26 years, then went to university and got a degree in astronomy. Now he is a tutor (in astronomy and planetary science) for the Open University and lectures in astronomy for other institutions.

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