



Book Review

THREE STEPS TO THE UNIVERSE:

From the Sun to Black Holes to the
Mystery of Dark Matter

*David Garfinkle and Richard Garfinkle,
Chicago: University of Chicago Press, 2008. 280 pp.*

Reviewed by Charles B. Lindemann

The inception of this review, as with many matters of intellectual importance, began with lunch.

After a hearty “meal” at the O.C., engaged in the universal faculty lunch topic of University politics, I accompanied Dave Garfinkle back to our usual hiding places. During transit, which was at academic speed, I posed a question to my cosmologist colleague. I said “why do things fall into a black hole, when planets do not typically fall into the sun?” It has been my distinct impression that planets seem to hang around the sun in orbits without showing any signs of falling into it, at least that I am aware of. David responded that that was an “excellent” question. Anyone familiar with the ways of academicians knows that this means he knows the answer. He gave me a most lucid explanation. It is due to a phenomenon called “magneto-rotational instability”. It has to do with the properties of plasma, which is what matter becomes when extremely overheated and angry. His answer was so easy to follow, and so sat-

isfying, that I said “you explain complex things extremely well, you should write a book”. He answered “I did”.

I bought the book, I read the book, and then two members of the Oakland Journal editorial board found out that I did. That came about because Chris Clason (lead guitar) and Brian Murphy (drums) are fellow band members of “The Mongrel Dogs who Teach”, and clearly I talk too much. Both of them ganged up and insisted that I would be the ideal person (spelled G, O, A, T) to write a review of the book for the Journal.

The book is *Three Steps to the Universe* and is co-authored by David Garfinkle and his brother Richard Garfinkle and published by the University of Chicago Press. It starts by asking, how do we know what we know about the sun? We can’t touch it, or explore it or examine it up close, yet we know a great deal about it. From that quite reasonable starting point the authors explain the steps that went into finding out about our local star (and one-time god). They go on to show that, once we had built the intellectual basis for detecting what is going on in and around the sun, it gave us tools that could be used to expand our understanding of the stars, the galaxy, and the whole universe.

If you read this book, you will learn how “parsecs” and “supernovae” can be made into rulers that allow us to measure the universe. You will learn where our basic atomic elements come from and you will learn that stars are born, live and die in a predictable series of stages. Best of all, it will be relatively painless. In fact it is all presented in a non-threatening and often entertaining way with some humor and some (mostly bad) puns; a feature which should appeal to the humanists.

You will find out how astronomers and astrophysicists figured out that our universe is expanding. The now accepted fact of that expansion has led astronomers to the inescapable conclusion that there was a big explosion long ago that created the present universe and also spawned a hit T.V. show. The authors then introduce us to the even stranger stories of **dark matter** and **dark energy**. These invisible materials are thought

to make up a whopping 95% of the universe. They explain why this must be so, and do their best to win you over to the **dark side**. If you pay careful attention you may well be able to explain the existence of dark matter and dark energy to your children and grandchildren. It is considerably easier than telling them about where babies come from and yet sounds much more impressive. They will think you are very smart indeed, and there will be no embarrassing collateral damage to your psyche.

I was so engaged in reading the book that I took full advantage of knowing one of the authors personally. I sent him frequent e-mails as I made progress through the book. He answered the first one very quickly, but I did notice that the responses slowed down a bit after about the third one. Maybe he left town. I asked him if it was true that time slows down to a stop at the event horizon of a black hole. He responded that this is one of the commonest “urban legends” concerning black holes. This really surprised me! I grew up in N.Y.C., certainly urban, but in my neighborhood I never heard that one. The one about alligators living in the sewers and growing to immense size eating the rats, that one was very well known, but really nothing at all about relativistic time dilation in black holes. I must have been in a low-end neighborhood: it was, after all, Staten Island, not Brooklyn.

The last part of the book returns to earth and considers the place of life in the big picture. The transition is smooth enough. The elements and molecules that the stars made are now cooking up “life”. At this point the Garfinkles are venturing out of their territory and more into mine, at least to the extent that I have a territory (it is just a small condo at the edge of the swamp). I can truthfully report that they get the biology pretty-much right. They give the main tenets of Darwinian evolution. They don’t venture into post-Darwinian evolutionary mechanisms. They do not, for instance, mention gene splicing, transposable elements, DNA silencing, epigenetic modifiers or (my personal favorite) sperm competition. These post-Darwinian additions to the tool box available to evolution do con-

tribute a bit to understanding how life shuffles the genetic deck to select for useful positive variations. They might consider looking into them for the next edition. As far as the authors go with evolution, they go correctly, and give a fairly good foundation to the reader.

What they really do exceptionally well is placing life into the grand scheme of things and showing how it fits into the physical universe. In fact, this was the very thing I liked best about their remarkable book. They build an almost seamless grand picture of the universe and our place within it. I have always thought that the greatest satisfaction to be derived from education is the construction of a personal world view. In this volume the brothers Garfinkle demonstrate a comprehensive and well developed world view that is quite impressive, and will likely expand the world view of the receptive reader.

Their last chapter, "Science as it is written," is a bit of complaining about the sad state of science journalism. It sounds the call-to-arms for more authentic science reporting, and rails against the minions of pseudo-science, sensationalism and outright hucksterism that are unfortunately all too common. It departs from the rest of the book in being a bit preachy. I confronted David about this. I told him that I agreed with their position, but that I thought it was the weakest component of the book. His learned response was that it was entirely his brother's fault! Alas some elements of the universe are . . . well . . . universal.

An interesting point made in the final chapter is that truth is often the loser in good storytelling. This is because storytelling requires "suspension of disbelief" on the part of the reader, and good science requires "suspension of belief". Happily, the Garfinkles show that it is possible to be respectful of the truth and still tell a good story.