

PREFACE TO THE SYMPOSIUM

A SYMPOSIUM ON TWO-DIMENSIONAL  
SCIENCE AND TECHNOLOGY

A.K. Dewdney  
Editor

This collection of articles and notes seems to be the most efficient way of communicating the ideas of the many individuals who have become interested in investigating scientific and technological possibilities within a two-dimensional universe since the publication of Martin Gardner's article on the subject in the July 1980 issue of the *Scientific American*. A limited budget, based on a break-even financial goal has, on the one hand, made it necessary to print material exactly as submitted by the many authors as well as to adopt the reduced, two-pages-per-page format. On the other hand, it has become possible, through this inexpensive printing technique, to produce a book which costs roughly the same as *Two-Dimensional Science & Technology* but contains much more material. Although many authors have followed the guidelines which I urged upon them, even those did not use the same typeface or employ a uniform set of typographical niceties. It would have been almost impossible, of course, to enforce such uniformities: not all authors had access to extensive typing facilities nor could it even be assured that all of the latter had the same typing element, for example. The result is hardly aesthetically pleasing but I sincerely hope that the resulting non-uniformities will be more than made up for by the interesting contents of this *Symposium*.

The response to Gardner's article on the planiverse has been very heartening and much of the material sent to me in response to this very public exposure of the planiverse appears here. It is too early yet to say to what degree it is all consistent, but it would appear at first sight that this speculative subject is well-launched and one looks forward to its further development. Two letters sent to me by physicists threaten to shake the very foundations of the planiverse, however. Because I could not persuade either author to write an article for the *Symposium*, I will undertake to represent their views in this preface.

Professor J.R. Gott III of Princeton's Department of Astrophysical Sciences, points out [2] that gravity cannot exist in the planiverse if one adopts an appropriately restricted version of standard relativity theory.

"General relativity in flatland predicts no gravitational waves and no action at a distance. A planet in flatland would produce no gravitational effects whatsoever beyond its own radius. In our four-dimensional space-time the energy momentum tensor has ten independent components, while the Riemann curvature tensor has twenty independent components. Thus it is possible to find solutions to the vacuum field equations ... which have a non-zero curvature ... Flatland has a three-dimensional space-time where the energy momentum tensor has six independent components and the Riemann curvature tensor has also only six independent components. In the vacuum where all components of the energy momentum tensor are zero, all the components of the Riemann curvature tensor must also be zero. No gravity waves or action at a distance are allowed."

The University of  
Western Ontario  
London, Canada  
N6A 5B9

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John Hornstein of Silver Spring, Maryland writes [3] of his investigation of universes with one and two\* spatial dimensions.

"...I soon found that one spatial dimension cannot lead to a world with significant structure (everything clumps together gravitationally; atoms can exist but there is no Pauli exclusion principle, so molecules and extended bodies collapse down to the atomic scale, and there is no periodic table); similarly, in two dimensions, the rotation group is commutative, so again there is no Pauli exclusion principle, and hence chemistry is trivial and there is no possibility of life."

If a consistent development of planiversal speculations is to take place, these comments must be answered by the informed adoption of a set of basic assumptions as a foundation for such development. Such assumptions would presumably use a form of Relativity theory which, while the same in the steriverse, becomes something a little different in the planiverse, hopefully predicting an inverse-linear law. At the same time, such assumptions would apparently have to rescue the Pauli exclusion principle from the commutativity of the rotation group in  $R^2$ .

In any event, it is to be expected that further speculations in two-dimensional science and technology will be taking place. These speculations, to the extent that they are to lead to a coherent, consistent body of theory, must be coordinated somewhat. Such coordination will be facilitated but not guaranteed by periodic publications such as this symposium. By the time this goes to press, I will have begun a process of inquiry among the many authors appearing here, as well as others who have indicated an interest in "participating", in order to discover how such a coordination might be managed.

A.K. Dewdney  
March 1981

- [1] P. Collas General relativity in two-and-three-dimensional space-times. Am. J. Physics 45 (1977), 833-837.  
[2] J.R. Gott Personal Communication, June 20, 1980.  
[3] J. Hornstein Personal Communication, June 12, 1980.

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\*Hornstein has sent a reference [1] to published work in this area.

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# PHYSICS