Games with Bubbles

An Invitation to a Wonder Land of Physics

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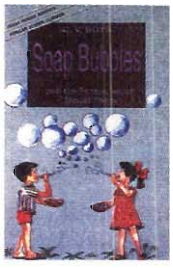

Soap Bubbles - And the Forces which Mould Them
C V Boys
Vigyan Prasar Reprints: Popular Science Classics,
Department of Science and Technology. New Delhi, 1995.
pp 109. Rs 30.

It is probably very difficult to find a person who has not been charmed by the exquisite beauty of soap bubbles. Invariably, our appreciation of soap bubbles ends with an admiration of their shapes and colours. We do not realise that there is a profound science behind their beauty. The best book to start learning the physics of soap bubbles is the monograph of Boys. His book which evolved out of three demonstration lectures has justifiably become a classic. The rich variety of experiments that are described without the aid of a single equation is really astounding. Natural phenomena and their relation to surface tension are discussed, a rare quality in present day text books. This book is a must in every science lover's book shelf.

Though the book is supposed to be on soap bubbles, Boys begins with a discussion of liquid drops. He appreciated the fact that a study of drops which is easy to undertake, naturally leads to the physics of bubbles as well. Boys was probably aware that practical hints would be necessary for anyone else even to repeat, let alone improve upon, his demonstrations. In view of this, he has given some useful tips towards the end of the book. These lectures can even be looked upon as a commentary on the classical physics of his times. Through a description of simple, elegant and beautiful experiments Boys builds the subject of surface tension and reveals its enticing effects. These experimental results are relevant even 106 years later. It is not out of place to recall a few of them here.

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The discussion on the effects of local variations in surface tension resulting from concentration or thermal gradients is very instructive. We have all read of the erratic motion of camphor on water. Boys argues that the same physics is behind the continuous burning of a candle or formation of wine drops on the walls of a vessel containing wine. His demonstrations on the instabilities in the shapes of drops are very impressive, in particular the one on the shape transformations in a rotating liquid drop. At low rotations it is flattened at the poles. At higher rotations it breaks into a liquid ring surrounding a flat drop. At much higher rotations the ring

C V Boys

C V Boys had varied tastes in science. He became internationally famous for his work on the measurement of the gravitational constant G. It may be pointed out that his early education was in mining and metallurgy and one of his early scientific papers, published in *Nature*, was on learning capabilities in garden spiders. Interestingly, he also wrote a book on weeds. He was one of the few scientists to successfully popularise science. Towards the tail end of 1889 he gave three lectures on soap bubbles to a juvenile audience. These lectures, delivered at the London Institute, were later enlarged into a book which saw many editions. Strangely, all these editions were published by ' The Society For Promoting Christian Knowledge' under the series ' The Romance of Science'. Boys lived to see the French, German and Polish translations of his book. Incidentally, he also developed a toy named 'Rainbow Cup' which was patented and released to the market. Here a flat soap film is spun at a high rate leading to a thinning at the centre which results in a ring of colours as in a rainbow. This was a popular toy for quite some time.

breaks into droplets orbiting the central flat drop. The experiments pertaining to cylindrical drops are simply beautiful. Their instabilities in a variety of situations have been described in simple terms. He gives elegant answers to such questions as: Why do we find fine beady strands in the web of a spider? Why does water running down a tap or emanating as a jet, break into droplets? In this context one of his demonstrations must have left a lasting impression on his audience. Boys showed that even the inaudible ticks of a watch can be made to echo aloud in a big hall by coupling it acoustically to a jet of water falling on a stretched rubber sheet. The growing instabilities act as an amplifier.

His adventures with bubbles are equally fascinating. Formation of bubbles inside bubbles, study of diffusion of gases through soap bubbles, effects of buoyancy on a bubble inside a bubble are some of the extraordinary phenomena discussed by Boys. There is also an interesting section on the production of curved soap films with 'zero' curvature and attractive soap film configurations inside wire frames of different geometries. Experiments pertaining to the mechanical strength of cylindrical bubbles are equally intellectually engrossing. Boys also considered in his book, the effects of electric fields on drops and bubbles. With electrically charged bubbles he demonstrates analogues of the Faraday cage and electrostatic interaction between charged bodies. His experiments on the effects of an electric field on the structure of jets are worth repeating even today.

The digression into curves in general and conic sections in particular is a pleasant inter-

Bashing the British System of Units

"I have felt constrained to use the archaic British units of measurement, as the unfamiliar metric terminology would have distracted the attention of the majority for whom this book is intended, who have spent untold hours that might have gone into mathematical or general education in performing ridiculous operations such as reduction, compound multiplication and practice which our British methods of measurement necessitate, but which in more enlightened countries are wholly unnecessary."

C V Boys, in his preface to the new and enlarged edition of the book 'Soap Bubbles'.

lude. His expositions on curves generated by the focus of a conic section as it rolls on a straight line are very illuminating. One effortlessly learns a lot of geometry relevant to the shapes of the bubbles.

Now about the Indian edition of this marvellous book. I could not lay my hands on the first edition of this monograph. However, I have gone through the 1920 edition and find that the Indian edition agrees with it in many respects. The Department of Science and Technology which financed this venture should be congratulated on undertaking such an activity. Also its decision to publish at a low price is truly commendable. Unfortunately, the Indian edition is not a good representative of the original monograph in some respects. The editors could have handled this task with a little more care. They provide their own 'explanatory notes' towards the end of the book. Some of these notes are even misleading. For example it has been stated that a gold-leaf electroscope detects radiation while in fact it can only detect ionizing radiations. The text needs the geometrical dimensions of shillings, etc, and not their monetary relationship with the British Pound. Further, Figure 17 is not consistent with the text pertaining to the instability of a rotating liquid drop.

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Complex Function Theory

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Gadadhar Misra

Notes on Complex Function Theory
Donald Sarason
TRIM #5, Hindustan Book Agency,
New Delhi 110 017. 1994.
pp 184. Rs 180.

Over the last few years, there has been a substantial increase in the number of text books on complex analysis. Most of these texts have common core material. There is no serious disagreement at present about the logical order in which this material must be presented. Besides, elegant and economical proofs have been found for most of the important results. This makes the task of writing a new book on complex analysis at an elementary