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An introduction to millikelvin technology

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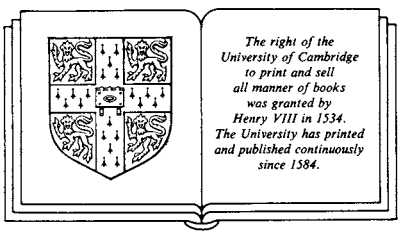

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Preface

The origin of this volume was an invitation I received from Dr Marek Finger of the Charles University, Prague, and the Joint Institute for Nuclear Research in Dubna, Russia, to give four lectures on low temperature methods at an international summer school on hyperfine interactions and physics with oriented nuclei organised at a chateau in Bechyně in the Czechoslovakian countryside, in September 1985. The topic of the summer school was something I knew little about, but low temperature physics is my métier and the preparation of the lectures was frankly not a large task, particularly in view of the fact that I was already the author of *Refrigeration and thermometry below one kelvin* (Sussex University Press, 1976). I decided to use a minimum of prose, produced in the usual garish colours, together with a large number of diagrams from various sources converted into transparencies. I would depend on my knowledge of the subject matter to talk through the transparencies in an unscripted way. It took me four days to think through the content and prepare the material. All the lectures were given on 3 September 1985. The organising committee originally had no intention of publishing proceedings but many participants expressed their desire to have the lectures and contributions presented in written form. My heart sank at the thought of converting my bundle of transparencies into something which could fairly be described as a camera-ready manuscript, but I agreed to try. It was like trying to turn a movie into a novella. I worked spasmodically on it, missing all of a series of extended deadlines until eventually the editors gave up on me and the proceedings appeared without my contribution. By this time I felt that I might as well finish what I had begun, and the *Four lectures on low temperature methods* appeared as a sort of private edition, available to some Sussex post-graduates but otherwise unknown. At this stage (August 1986) I sent a copy to Dr Simon Capelin of CUP with whom I had earlier been in correspondence about another project and offered to undertake a

further but limited expansion of the work into the present book form. I had half expected this proposal to be rejected, but in fact some very helpful suggestions were made by Dr Peter McClintock and I was encouraged to proceed. By this time I had all the written material on word-processor disks and the rearrangements and expansion progressed steadily until I submitted the manuscript in June 1987. The integrated amount of work over the whole period was far more than I would ever have agreed to as a package, but because it had three distinct stages it always seemed a manageable task.

I mention all this because the final form has been to a large extent determined by its history. It is short, and it has a high figure/text ratio. The figures are not intended merely as adjuncts to the text; rather it is intended that the reader should spend time absorbing the significance of each before moving on. Also it is important to realise that it is in no way intended as a substitute for my *Refrigeration and thermometry below one kelvin* (1976) or for O.V. Lounasmaa's *Experimental principles and methods below 1 K* (1974), both of which are still available as more advanced sources.

This short work is intended as an introduction to the experimental technicalities of low and ultralow temperature physics research. It is likely to be of greatest value firstly to those who are beginning such research either as postgraduate students or as seasoned researchers moving in from another field, and secondly to final-year undergraduates choosing a low temperature physics option. There is a deliberate attempt to use diagrams as aids to understanding, and to refer readers to the professional literature as soon as the level of understanding is high enough.

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