

PREFACE

WHY APPROACH the foundations of quantum mechanics, this vast and fascinating subject area, through interviews? Why not a proper textbook instead? After all, many of the classic titles, such as Max Jammer's *The Philosophy of Quantum Mechanics* and Bernard d'Espagnat's *Conceptual Foundations of Quantum Mechanics*, have aged visibly. A complete, up-to-date account of the field—one that would also pay appropriate attention to recent developments like quantum information, experiments, and reconstructions of quantum theory—is arguably lacking. I'm well aware of this situation. So it is not as if the idea of writing a textbook hadn't ever occurred to me, or as if I simply shied away from the effort, however enormous I suspect the investment would have to be.

Opting for the interview format instead is, as I see it, neither a cheap cop-out nor merely a temporary substitute. Rather, it is a uniquely effective way of laying out the field of quantum foundations as it stands today. It won't be news to you that this field is no cut-and-dried solid-state physics: just attend any conference devoted to quantum foundations, and you'll know that the debates at such events have the zeal of a political convention. How could a single author do the field full justice without coloring her story? I do think it could be done, but you'd have to be a card-carrying member of the Party of Utterly Neutral Quantum Scholars ("Punqs") not to be accused of supporting, however subtly, the line of a particular foundational program or mindset.

The interview approach has diversity built in from the outset. It allows you to perceive the subject through the eyes of the field's leading practitioners. You won't need to go through stacks of research papers to get a representative cross-section of views, or trust any one author to faithfully reproduce all the shades of gray. Last but not least, interviews lend themselves to an informal and personal style. After all, we read books for enjoyment. They shouldn't be a slog.

Of course, if not handled judiciously, the interview approach can also go astray. One obvious make-or-break issue is the choice of questions. There's always a danger of bias, of putting spin on the questions. Here are some of the goals I set out.

I wanted the questions to cover a wide range of topics, so that this book would provide a comprehensive reflection on the field. There are, of course, the standard themes: interpretations of quantum theory, the measurement problem, quantum states, probabilities, issues of nonlocality and completeness, and the like. But included as well are questions on newer areas, such as quantum information and reconstructions, and about interdisciplinary aspects, such as the role of philosophy and the implications of our quest for a unified theory.

Another goal was to phrase the questions in reasonably broad terms, because I didn't want the respondents to get caught up in technical details, nor did I want to unduly restrict the range of possible answers. At the same time, I tried to keep each question focused on a well-defined topic, so that answers can be compared side by side and don't turn into blanket statements and clichéd generalizations.

I also wanted to leave room for personal stories among all the heavy going. How did people originally become interested in quantum foundations? What would it take for them to embrace a rivaling view? What role do they attribute to individual temperament when it comes to the choice of foundational agenda? Those kind of questions.

Picking participants for the interviews can be treacherous territory as well. On a practical level, we may tend to choose people we already know well, thereby running the risk of inadvertently excluding the up-and-coming talent or the recluse. On a psychological level, we may gravitate toward people who share our own worldview. I tried my best to assemble a cast that would do justice to the diversity of the field. The interviewees for this book come in all foundational stripes: agnostics, informationalists, Bohrians, Everettians, Bohmians, Bayesians, collapsists, ensemblists, reconstructionists—you name it. They come from physics, philosophy, and mathematics departments, and they range in age from the budding young academic to the distinguished emeritus professor who might have shaken hands with Einstein and Bohr. A serious lack of diversity, however, occurs in the gender department, as all participants are men. Another reflection of how regrettably male-dominated the world of physics (and the philosophy of physics) is! I lament this situation as much as you do, and if you'd like to suggest suitable female participants for a future edition of this book, please let me know.

A few words on how the book is organized. Biographical sketches introduce the participants at the beginning of the book. I put the same seventeen questions to each of the seventeen participants (the identical numbers are pure coincidence). All interviews were conducted in writing. Answers were limited to about one page in length, *on average*, and nothing has been omitted here.

A minimal background in quantum mechanics should be all you need for this book. There's a glossary at the end of the book (page 295) that explains some of the technical terms repeatedly appearing in the interviews. Have a look there if you're new to the field.

As for the grouping of the interview answers, there are two obvious alternatives: by respondent or by question. Organization by respondent emphasizes autobiographical coherence, allowing respondents to build a continuous argument. Organization

by question stresses thematic coherence, allowing you to easily compare the different positions on a particular issue. I decided that it was this possibility of direct comparison that mattered most. So I chose organization by question. This format also means that you won't have to make your way through seventeen separate interviews that each tick off the same list of questions—something that could quickly become tiresome. And the certain amount of autobiographical discontinuity inherent in the grouping-by-question approach can also turn into an asset, because it compels the respondents to treat each question as an independent entity, thus making answers more self-contained.

Each chapter is devoted to one particular interview question. It kicks off with a few opening remarks to whet your appetite. These teasers are not meant to amount to any kind of in-depth review. Obviously, a question like “What single question about the foundations of quantum mechanics would you put to an omniscient being?” wouldn't anyway lend itself to much of a technical survey. In other instances, when a particularly juicy question comes along—say, concerning the Bell inequalities or the meaning of quantum states—I provide a highly compressed introduction to the subject. To go any further would be to infringe on the interviewees' territory.

This is not the first interview book on quantum mechanics. In the early 1990s, Julian Brown, a radio producer with the BBC Science Unit, teamed up with Paul Davies to do a series of interviews with physicists interested in the foundations of quantum mechanics. Davies presented these interviews in the form of a program for BBC Radio 3, featuring conversations with Alain Aspect, John Bell, John Wheeler, Rudolf Peierls, David Deutsch, John Taylor, David Bohm, and Basil Hiley. The program found enthusiastic listeners, including at least one of our interviewees (see Lucien Hardy's story, page 29). Buoyed by this success, Brown and Davies decided to publish the transcripts of the interviews in book form. *The Ghost in the Atom: A Discussion of the Mysteries of Quantum Physics* came out in 1993.

It's a delightful little book, and I recommend checking it out when you have the chance. Two decades on, it feels a little dated, though a good number of the issues it discusses are as fresh as ever. In many ways, *The Ghost in the Atom* is rather different from the book you're holding in your hands. It is organized by respondent, and the questions change from interview to interview and focus on the respondents' individual foundational research programs. Curiously, it so happens that none of the people interviewed in *The Ghost in the Atom* appear in this book. So the two books are perhaps best regarded as complementary.

My thanks so, first and foremost, to the participants themselves. This book would not exist without their generous offer to lend their time and voice to the project, and it would be worthless without their insight and wisdom. When I first sent out the interview invitations, something miraculous happened: not a single person declined. These consistently positive initial responses were enormously encouraging and got the project off to a good start. And as the interviews came trickling in, one by one over the course of several months, I was amazed by the depth and diversity of the responses, and humbled by the effort and thought that had gone into them. Spe-

cial thanks go to Chris Fuchs and David Mermin, who, besides their own answers, contributed a number of helpful comments and suggestions.

An essential part in making this book a reality was played by Angela Lahee, editor at Springer. Angela is the kind of editor the doomsayers tell us no longer exists. For several years now, she's been a trusted friend and confidante who is always willing to share her expertise and lend a sympathetic ear. Right from the moment when I first put the idea of this book to her, Angela threw her wholehearted support behind it. Her feedback accompanied the making of the book from start to finish. In particular, she provided thoughtful comments on the interview questions and on a draft of some of the chapter introductions.

At the end of the day, what really enables us to do what we do is the nourishment we get by being around the people dearest to our hearts. I'm most grateful to my wife, Kari, and to my son, Eli, who was born last year, for all the love and happiness we share every day. And thank you, Kari, for all your untiring patience and encouragement while your man is working on yet another weighty tome.

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