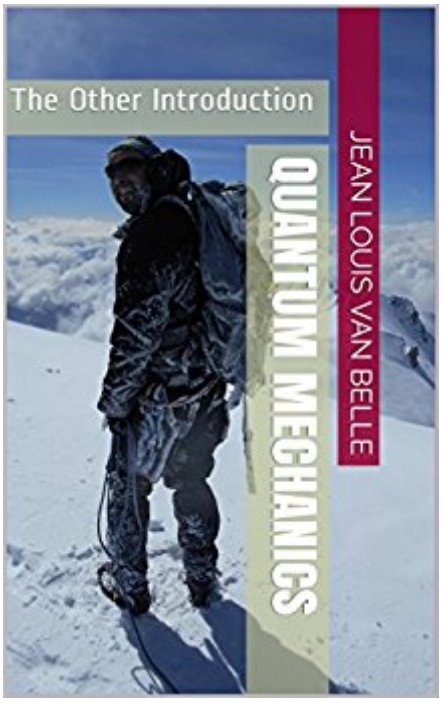
Quantum Mechanics: The Other Introduction



Synopsis

This short text is an accessible, intuitive, and formally correct overview of the key quantum-mechanical concepts and constructs, with a focus on the wavefunction and SchrÃ¶dinger's wave equation. It is very different from other introductory material. First and foremost because of the author: unlike other writers on the subject-matter, Van Belle first graduated as an economist, and worked in government and business before taking an interest in physics. Hence, he learned quantum mechanics the hard way: at a much older age, and as a citizen from an entirely different world. This makes for a refreshing - sometimes even humorous - approach.The book explains the math one needs (complex numbers and simple differential equations) but it does so incorporating three distinctly new didactic perspectives on the subject-matter. First, Van Belle incorporates relativity straight from the start by showing that the argument of the wavefunction is just the proper time of the object it describes, with the rest mass as the time scaling factor. The related symmetry between the reference frame of the object and that of the observer is easy to grasp, and lead the reader to understand the wavefunction in a much more intuitive way, without sacrificing mathematical or scientific accuracy in any way. This approach is complemented by two even more remarkable innovations in teaching the subject. First, the book demonstrates that there is a wavefunction (and SchrÃ¶dinger equation) not only for matter-particles (e.g. electrons) but also for spin-0 and spin-1 bosons (photons). While this approach reflects Feynmanâ ™s idea of the photon stopwatch, Van Belle goes much beyond. He shows, through a series of transformations of Maxwellâ ™s equations in free space, that both mathematical descriptions of the photon - i.e. as a wavefunction and as the sum of the electric and magnetic field vector - are fully equivalent. While doing the transformations, Van Belle keeps a constant eye on the physical dimensions of the space that is being transformed, and thereby convincingly demonstrates how the wavefunction â " for bosons as well as fermions â " can be analyzed as an energy propagation mechanism. This takes the reader to a most remarkable but intuitive conclusion: while all of the abstract mathematical models analyze particle-waves as oscillations IN (mathematical) spacetime, Van Belle shows they can - and probably should be - thought of as oscillations OF (physical) spacetime, whose dimension is the physical action dimension (newton-meter-second), and which may express itself either in time (as energy) or in space (as momentum). In this radically new perspective, Minkowski's mathematical spacetime re-acquires the physical dimension it always had, but which - as a result of the mathematization of physics - got lost somewhere, thereby preventing both scientists and amateurs from acquiring the kind of deep understanding they are seeking. The overall message of this book is delightfully refreshing: Van Belle disagrees with those who tell us we cannot really 'understand'

quantum mechanics the way we want to understand it, with those who say it’s all just math, and one shouldn’t try to think beyond the math. As such, the book gives the reader a true glimpse into the mind of the likes of Planck, Einstein, and all of the pioneers of quantum physics, who were effectively among the very few, one century ago, who, instinctively and intuitively, understood what Minkowski’s famous words actually meant: space by itself, and time by itself, are just shadows of a deeper and independent reality. This new introduction surely tries hard to conveys that original understanding. It does not make for easy reading but, as the author, who is also a passionate mountaineer, puts it: the whole journey is an extraordinary climb, but the view from the top is magnificent, and well worth the effort.

Book Information

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Customer Reviews

Warning: this is not your ’popular science’ introduction to Quantum Mechanics. Jean-Louis takes you with him on his own personal journey as a non-physicist to discover the deeper meanings and interpretations of quantum mechanics. The good news is that he started off with no university training in the natural sciences, so if you are ready and committed, you can follow him through his explorations and slowly let him guide you to "the top where the views are stupendous". However,

the bad news is that there is some serious uphill, and thus commitment, required from the reader. Firstly, you have to be fit enough to climb the mountain - meaning you will have to be prepared to face the mathematics as Jean-Louis slowly (or, actually, rather quickly :-) explains them *and do the exercises so that you understand them deeply enough*. Then, secondly, you will have to climb the mountain - there are no shortcuts or teleferiques to carry you up: you have to work through the explanations and figure them out till you understand them (often with a bit of additional information and study from the internet). No shortcuts, no quickies, no pain-free journey. But, the task is made lighter by Jean-Louis' irreverence for established authorities, his tongue-and-cheek comments, the light-heartedness and above all his personal writing style which makes it seem as if he is standing right behind you and having a personal conversation with you as you (not read but) work your way through this. Note: if you're a cheap-skate, you can get most of the content from his blog site; however, this book has strung the blogs together in a more logical fashion, slowly building up to the climax. Of course, he's also revised some of the material and filled in some blank spots.