



**Physics Matters by Vasant Natarajan  
Published by World Scientific Publishing  
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Paperback Rs 497 (USD 12.2; Hardcover Rs.  
4064, Kindle Rs. 566.2) from Amazon.**

“Physics Matters” by Vasant Natarajan, is an excellent refresher book on various concepts of physics. It should not be confused with “Physics Matters: An Introduction to Conceptual Physics” by James Trefil, Robert M. Hazen published by Wiley.

The book contains a dozen chapters addressing interesting topics, controversies and debates in physics and goes on to discuss recent Nobel prizes. Many of the chapters revolve about radiation.

The book starts with an excellent exposition on Oscillations, starting at the elementary level, moving to finite amplitude, parametric amplification, elementary description of squeezed states. He briefly discusses the separated oscillatory fields method, which however, could have been elaborated a bit more. This was followed by a short discussion on coupled oscillations, very briefly touching on Rabi oscillations and how compression changes band gap in solids. This was followed by any interesting

section on how coupled oscillator idea can be used to understand spontaneous decay.

The second chapter is on the myth of biological effects of cell phone radiation. The author discusses the energetic of cell phone radiation and how radiation is linked to cancer and presents epidemiological studies negating claims.

In the third chapter the author takes up the subject of classical versus quantum reality in his discussion on what Einstein meant when he said “God does not play dice..”. He recapitulates Einstein’s reservations on the probabilistic and nonlocal nature of quantum mechanics. The author discusses how General Relativity is intrinsically nonlinear, as the dynamics of an object is not only governed by the nature of space and time but also in turn affects the nature of space and time. Both electromagnetism and quantum mechanics are linear. Also, from Mach’s hypothesis, inertia is not just a property of an object but is due to all matter (including the effect of distant stars) surrounding it. The author discussed how Einstein’s reservation on Quantum mechanics is based on all of these concepts.

In the fourth chapter Einstein’s treatment of Planck distribution using the concept of stimulated radiation is discussed. The author discusses how the Plank distribution of radiation does not affect the Maxwell-Boltzmann distribution of radiating and absorbing atoms in an enclosed space. This is an area that is usually not well presented in many text books. He also discusses two gedanken experiments by Einstein which necessitates the curvature of space-time and the gravitational red shift.

In the fifth chapter he discusses units of measure from the norms to how the accuracy improves exponentially with time.

The sixth chapter discusses the twin paradox. Normally one presents the paradox where one of the twins is stationary on earth, while the other makes a trip through space at high velocity and is found to have aged less when reunited with the earth-bound sibling. Here the situations of the two individuals have been different, as one was stationary on earth and the other one was zipping through space (though the relative velocity of the earth-bound twin is equal and opposite with respect to the travelling twin). One always wonders what would have happened if the situation were symmetric, who would have aged faster. The

author addresses this issue as well and how gravity affects the age of the earth-bound twin.

In chapter seven the author discusses Dicke narrowing of line width and super-radiance.

In chapter eight he discusses the physics of laser cooling, optical molasses (the topic of 1997 Nobel prize in physics) and magneto-optic traps.

This leads to experimental verification of Bose Condensation in chapter nine (the topic of 2001 Nobel prize in physics).

Chapter ten presents laser based precision spectroscopy, the topic of Nobel prize in physics in the year 2005. Use of pulsed laser with a definite repetition rate gives rise to equispaced peaks in its Fourier spectra (optical frequency comb) which helps in precise determination of frequency.

In chapter eleven the author discusses two inventions

– the optical fibre and charge-coupled devices, the topics of Nobel prize in physics in the year 2009.

Some experimental methods that enabled measuring and manipulation of individual quantum systems, for which the 2012 Nobel prize in physics was awarded is presented in chapter twelve.

This book is slightly skewed towards optics, however, it also addresses topics which are grossly overlooked and misunderstood. This book would form an excellent companion study material for an undergraduate physics major and also refreshes the understanding in certain areas of physics for seniors as well. This is an excellent book covering topics ranging from the simple ones to those of recent Nobel prizes. □

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