



## Elementary Particles and Fields

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# ELEMENTARY PARTICLES AND FIELDS

## The Discrete Charm of the Elementary Particles (abstract)

Maria Cristina Batoni Abdalla

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*The Discrete Charm of the Elementary Particles* is not only a textbook, but also a website and a DVD. It was prepared to help the Brazilian high school system implement its modern physics curriculum. Some of the greatest challenges, in recent years, of theoretical physics include understanding the universe in its micro and macro domains as well as building theories that can bridge the gap between these two extremes. The work presented in this book brings to the reader the history of this great journey through nature. In simple, direct, and precise language, the book tells us about the elegant organization that characterizes the field of elementary particles as well as the fundamental fields that describe their interactions. In the book, the reader will discover the time line in which discoveries and key ideas unfolded in this area of physics during an ever-changing twentieth century. The possibility to contextualize these events is a timely opportunity to show the general public the underlying relationship between physics and society.

The text was written to enable schoolteachers to improve their knowledge of, and help them teach, modern physics in an easy way. The book was printed by the official university press, and soon after its publication, a 52-minute film for teenagers was produced by a TV educational channel. The book has been introduced to more than 4,000 schools in the state of São Paulo as an official government program. Recently, the Brazilian Ministry of Education has transformed the book into a DVD and donated copies to the schools.

A website was developed as a tutorial for high school teachers in order to introduce the concepts of the elementary particles of the Standard Model at the secondary level. The DVD shows a harmonious and stimulating way of presenting the history of the elementary particles and their fundamental interactions. Since the discovery of the very first elementary particle up to the prediction of exotic particles, we present the Standard Model, including new manifestations of matter, and these growing new opportunities to read nature.

A project joining a few university institutes (modern languages, computer, and education) to implement legends in several languages is in the works. It is translated into English and can be downloaded for free on the Internet at [www.ift.unesp.br/users/mabdalla/media/formulario-dvd.html](http://www.ift.unesp.br/users/mabdalla/media/formulario-dvd.html).

## Axigluons and the Top Asymmetry (abstract)

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We studied an  $SU(3) \times SU(3)$  axigluon model introduced by Frampton, Shu, and Wang to explain the recent Fermilab Tevatron observation of a significant positive enhancement in the top quark forward-backward asymmetry relative to standard model predictions. First, we demonstrate that data on neutral  $B_d$ -meson mixing excludes the region of model parameter space where the top asymmetry is predicted to be the largest. Keeping the gauge couplings below the critical value that would lead to fermion condensation imposes further limits at large axigluon mass, while precision electroweak constraints on the model are relatively mild. We further explore the implications of phenomenological approaches and ongoing hadron collider searches for new color-octet gauge bosons. We conclude that simple axigluon models are unlikely to be the source of the observed top quark asymmetry, and we are exploring extended models with two sets of nearly degenerate axigluons.

*Women in Physics*

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