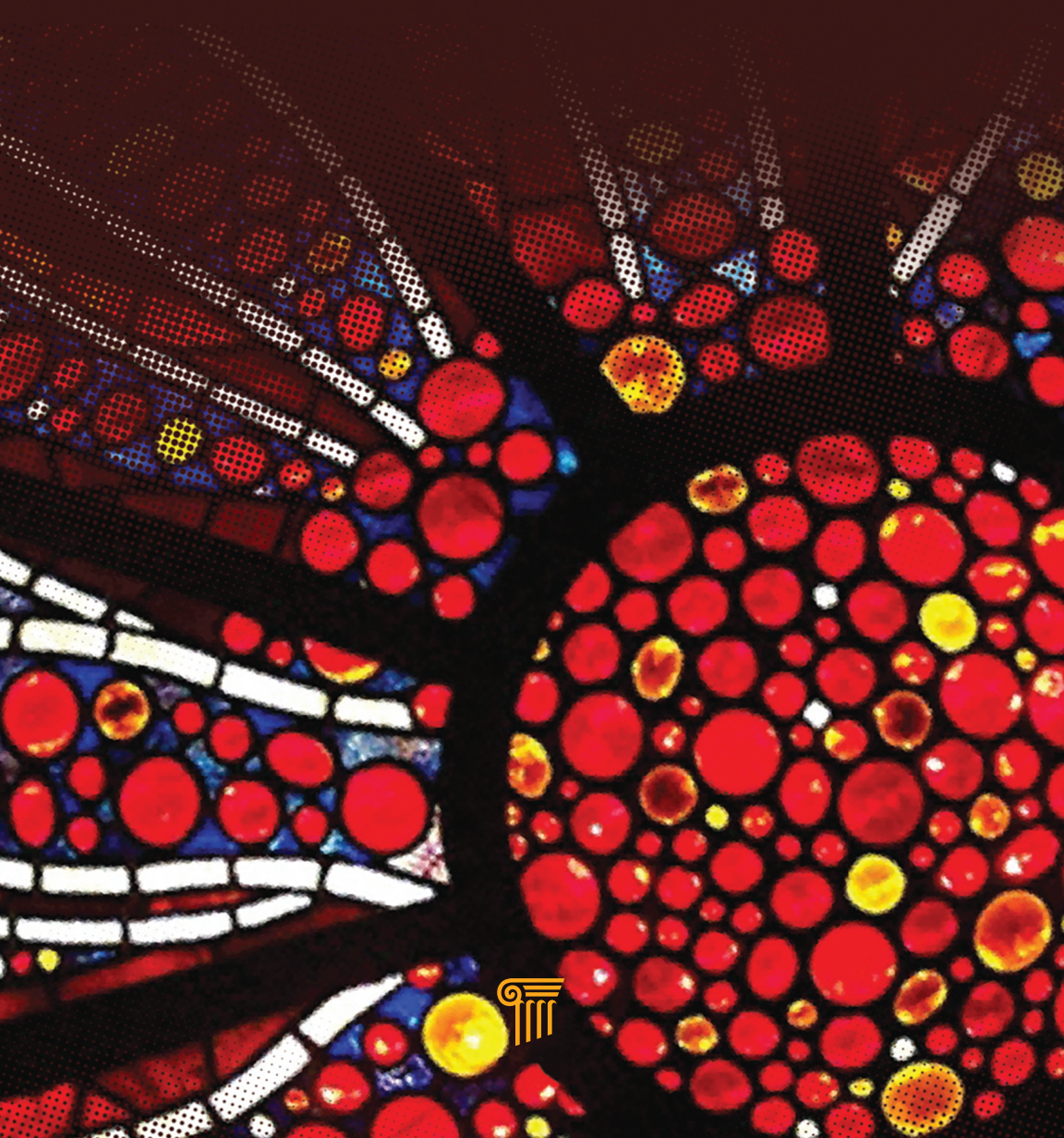
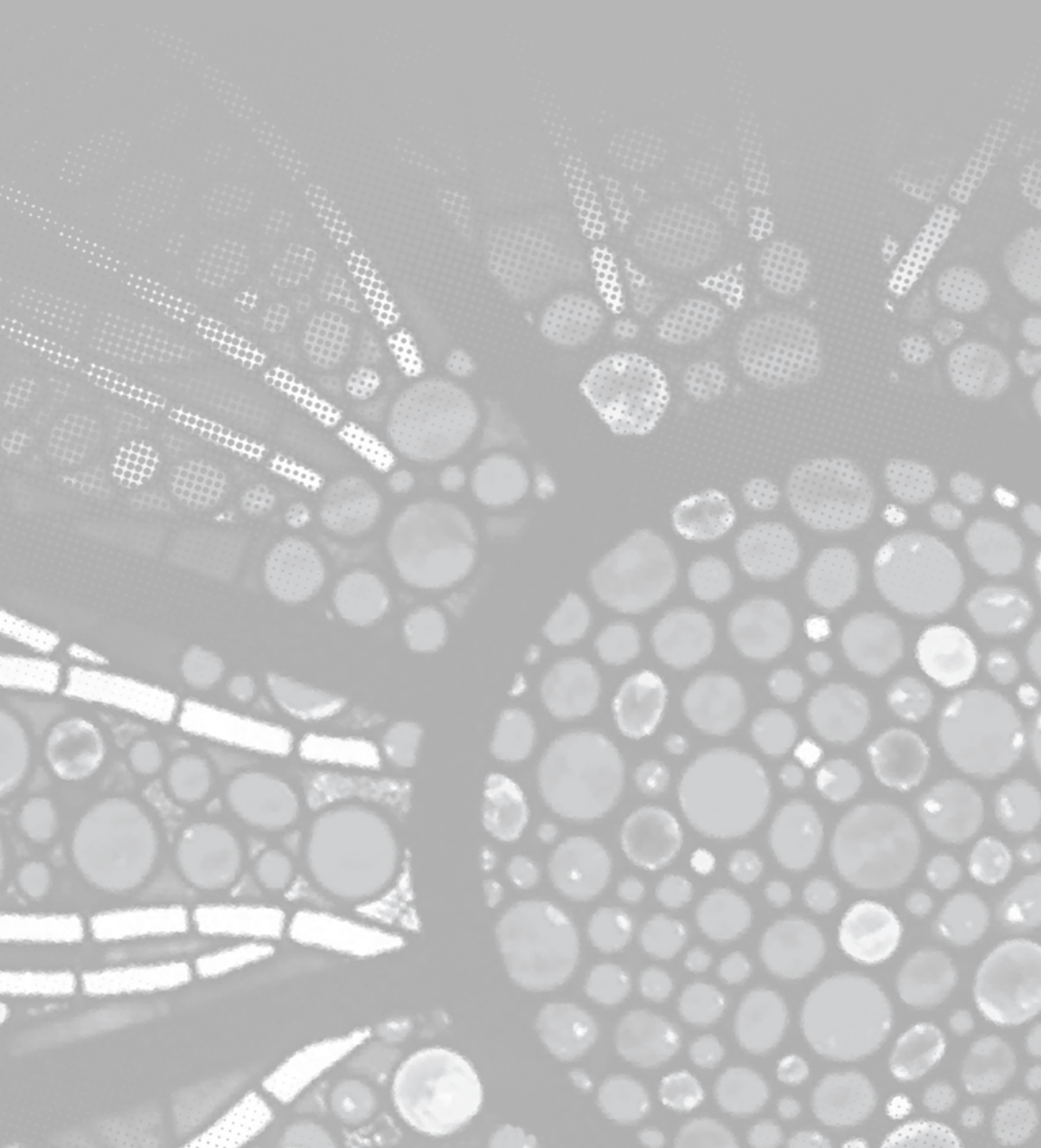


NANO PLASMONICS

Vasily Klimov



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Translated from the Russian by
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Preface

Nanoplasmonics is a component of nano-optics, which is optics at the nanometer scale. The subject of nanoplasmonics is optical properties of metal nanoparticles and nanostructures determined by electron oscillations around a crystal lattice. Primarily, the importance of nanoplasmonics is based on two factors. First, localization and enhancement of optical fields can occur owing to the presence of a spatial nanoscale substance (the lightning rod effect). Second, frequencies of metal nanoparticle eigenoscillations are located in optical spectrum in ranges from ultraviolet to infrared. Coexistence of these two properties of metal nanoparticles causes an interesting and complex physics, which forms the basis for numerous applications.

More specifically, the properties of metal nanoparticles and related physics are determined, first of all, by their shape: any variation from a trivial spherical form leads to the origin of new properties and peculiarities. Almost full control over shapes of nanoparticles allows one to talk about full control over their optical properties. The adjustability of plasmonic nanoparticles allows for their effective interaction between themselves and with light, atoms, and molecules. In other words, this book deals with the investigation of the influence of the geometry and shapes of nanoparticles on their properties. This aspect is extremely important because until now for simplicity many researchers have considered wave propagations in infinite systems which have no peculiarities related to real nanoparticles of finite volume. Moreover, sometimes such infinite systems have pathological properties.

Despite the rapid growth of nanoplasmonics, its main achievements are scattered over many journal publications, and one of the main goals of this project is to make a first-time systematic

presentation of results obtained over the world. Though many results in this area were obtained by me personally, this book is based, of course, not just on my results. I have tried to make the book as self-sufficient as possible from the theoretical point of view, and I expect that many formulas can be used immediately by both theorists and experimentalists in nanoplasmonics and related areas. Theoretical methods and approaches presented in the book can be also applied in further original investigations. As to the experimental aspects of nanoplasmonics, this work contains, first of all, an overview of fundamental experiments and applications having reputable substantiation and interpretation.

Although I have tried to make the book comprehensible to a wide audience, some parts of it are rather complicated and need special grounding. That is why for better perception the book is supplied with a lot of photographs, pictures, plots, and diagrams. These illustrations will be especially useful for those readers who have just entered into this domain of science. From this point of view, the electronic edition will be most useful because the majority of illustrations in it are in full color.

Although currently nanoplasmonics is of great importance, I decided to issue this book in English only after I felt assured that its tone is correct and the book is demanded by the audience. More than 1500 copies of two Russian editions have already been sold, and this circulation can be regarded as a success for a scientific book. I believe that the English version of the book will be even in greater demand because it is extended and updated to include further development of nanoplasmonics.

Vasily Klimov

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Finally, I am deeply grateful to the famous physicist Vladilen Stepanovich Letokhov (1939–2009), who, many years ago, drew my attention to new areas of science that did not exist at that time—nano-optics and nanoplasmonics.

Vasily Klimov

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