



Femtosecond Laser Filamentation: 55 (Springer Series on Atomic, Optical, and Plasma Physics)

See Leang Chin

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This book attempts to give a discussion of the physics and current and potential applications of the self-focusing of an intense femtosecond laser pulse in a transparent medium. Although self-focusing is an old subject of nonlinear optics, the consequence of self-focusing of intense femtosecond laser pulses is totally new and unexpected. Thus, new phenomena are observed, such as long range filamentation, intensity clamping, white light laser pulse, self-spatial filtering, self-group phase locking, self-pulse compression, clean nonlinear fluorescence, and so on. Long range propagation at high intensity, which is seemingly against the law of diffraction, is probably one of the most exciting consequences of this new sub-field of nonlinear optics. Because the intensity inside the filament core is high, new ways of doing nonlinear optics inside the filament become possible. We call this filamentation nonlinear optics. We shall describe the generation of pulses at other wavelengths in the visible and ultraviolet (UV) starting from the near infrared pump pulse at 800 nm through four-wave-mixing and third harmonic generation, all in gases. Remote sensing of fluorescence from the fragments of chemical and biological agents in all forms, gaseous, aerosol or solid, inside the filaments in air is demonstrated in the laboratory. The results will be shown in the last part of the book. Through analyzing the fluorescence of gas molecules inside the filament, an unexpected physical process pertaining to the interaction of synchrotron radiation with molecules is observed.

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