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Visible from invisible: Second harmonic generation with infrared laser diodes

Frequency doubling of the infrared laser light based on the generation of new laser wavelengths via material's nonlinearity is one of the most attractive ways for the realization of compact visible laser sources with a number of cutting-edge applications, which are supported both by the market and the technology via availability of compact and highly-efficient infrared laser diodes. However, for efficient conversion, or second harmonic generation, both photon and momentum conservation are to be achieved simultaneously. The last requirement (also called "phase-matching" constraint) is difficult to achieve due to dispersion of the refractive index in the nonlinear crystal. To date, by far the most commonly used approach for the phase-matching between interacting waves is the periodical poling (or "quasi-phase-matching") of the ferroelectric nonlinear crystals by periodically reversing the crystals polarization under large electric field. In this talk, we provide a fundamental generalization of quasi-phase-matching based on the multi-mode matching and fractional-order poling techniques. With these techniques, an order-of-magnitude increase in the wavelength tunability range for frequency conversion from a single crystal is enabled, thus offering a preferred way for the realization of a compact and spectrally-flexible laser sources in the visible wavelength range.

Biography

G S Sokolovskii is the Leading Research Fellow at Ioffe Institute (St. Petersburg, Russia). He has graduated from the St. Petersburg State Electrotechnical University 'LETI' (St. Petersburg, Russia) in 1994 (MSc) and has received his PhD and Doctor of Science (Habilitation) degrees from Ioffe Institute (1998 and 2010, respectively). His main research interests include Laser Physics, Nanophotonics and Physics of Semiconductors. He has authored and co-authored over 200 peer-reviewed publications and 10 patents on these topics. He is the Professor of the Russian Academy of Sciences and serves as the Vice-chair and Treasurer of the St. Petersburg Chapter of IEEE Photonics Society.

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