THE CONCEPT OF MULTIPLE NONCRITICAL PHASE-MATCHINGS ON A NON-LINEAR FREQUENCY CONVERSION IN BIAXIAL CRYSTALS

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S u m m a r y

A general approach to the analysis of conditions of the noncritical phase matchings (PMs) of various multiplicities in the process of generation of a summary frequency is developed. As an example, the analysis is applied to a KTP (potassium titanyl-phosphate) biaxial crystal. The approach is based on both the consideration of general properties of the PM surface constructed in the coordinates of the frequencies and the propagation angles of interacting waves and the analysis of their singular lines and the intersection points of these lines. On the PM surface, we consider the lines of noncriticality in the signal frequency or the propagation angles of the pumping wave and the signal one. A classification of twice noncritical PMs (in the frequency and one angle or in two angles) is proposed. It is found that the region of double noncriticality in the frequency and the IR signal divergence can be scanned over the whole transparency region of the KTP crystal on the tuning of the frequency of a long-wavelength laser pumping. A new type of the multiple noncritical synchronism (conditional PM) that is realized on the consistent change in the directions of the pumping and signal waves in the region of the maximum angle between the interacting waves is analyzed. Is is shown that the noncritical matching can be realized in three independent parameters — frequency and two angles. The use of the multiple noncritical PM allows the visualization of wide-band IR spectra and IR images and the frequency conversion of femto-second laser pulses.