## 282.

标题: Precise real-time polarization measurement of terahertz electromagnetic waves by a spinning electro-optic sensor

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摘要: We propose and develop a method to quickly and precisely determine the polarization direction of coherent terahertz electromagnetic waves generated by femtosecond laser pulses. The measurement system consists of a conventional terahertz time-domain spectroscopy system with the electro-optic (EO) sampling method, but we add a new functionality in the EO crystal which is continuously rotating with the angular frequency omega. We find a simple yet useful formulation of the EO signal as a function of the crystal orientation, which enables a lock-in-like detection of both the electric-field amplitude and the absolute polarization direction of the terahertz waves with respect to the probe laser pulse polarization direction at the same time. The single measurement finishes around two periods of the crystal rotations (similar to 21 ms), and we experimentally prove that the accuracy of the polarization measurement does not suffer from the long-term amplitude fluctuation of the terahertz pulses. Distribution of the measured polarization directions by repeating the measurements is excellently fitted by a Gaussian distribution function with a standard deviation of sigma = 0.56 degrees. The developed technique is useful for the fast direct determination of the polarization state of the terahertz electromagnetic waves for polarization imaging applications as well as the precise terahertz Faraday or Kerr rotation spectroscopy. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.3683570]

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