

本文提出了一种在电光周期性极化铌酸锂晶体中减慢光信号的方法。当在周期性极化铌酸锂晶体上施加横向电场的情况下，将在该晶体中形成光子禁带。在禁带附近的入射光的群速度可以通过改变电场强度或者调节入射光的波长来有效控制。在实验上我们观测到了最大可达20ns的时间延迟量，这一结果将在电光和全光的信号处理领域有很好的应用。这种方法可以同时具有高速、所需入射光的强度低以及可在室温下操作等优点。

A method was demonstrated for slowing light signals in electro-optical periodically poled lithium niobate crystal. A forbidden band gap can be formed when the transverse electric field exceeds zero. The group velocity of a light near the band gap can be delayed via changes in electric field strength or wavelength, with a maximum delay of 20 ns in the experiment, which is attractive for electro-optical signal processing and all-optical signal processing. It should be noted that this method simultaneously allows for high speed, low-light intensity, and room-temperature operation.

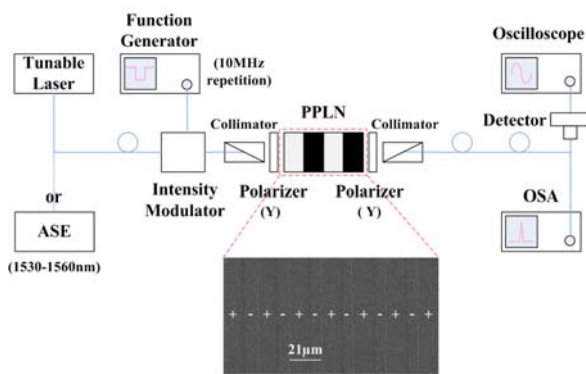


Figure 1 | Experimental setup for slowing light signals. A PPLN crystal, which is Z cut, is placed between two parallel Y-oriented polarizers. The light propagates along the X direction, and a uniform electric field is applied along the Y axis of the PPLN sample.

图1 | 减慢光信号的实验装置图

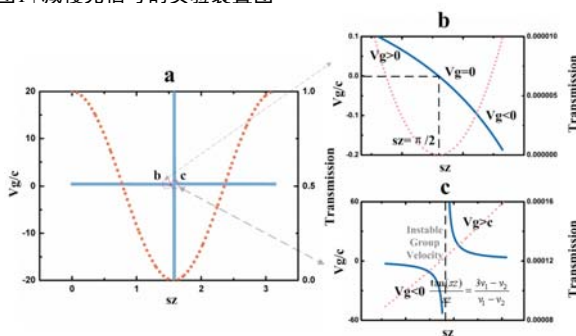


Figure 2 | Theoretical results on the group velocity (solid line). The dotted line represents the corresponding transmission..

图2 | 理论计算的群速度及相应的透过率曲线

Slow light occurs in the vicinity of the photonic band gap, small change of the electric field or the wavelength causes large change of the group velocity or the delay of a signal.

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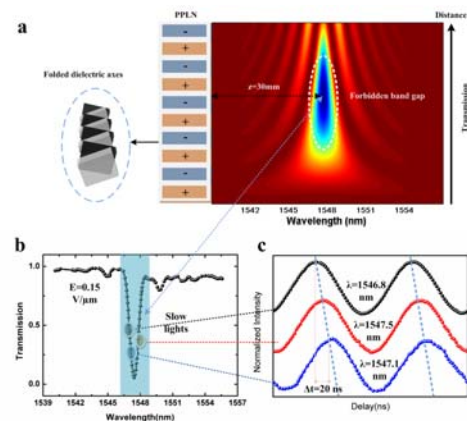


Figure 3 | Experimental results of the signal waveforms at different wavelengths.

图3 | 不同入射波长光的延迟

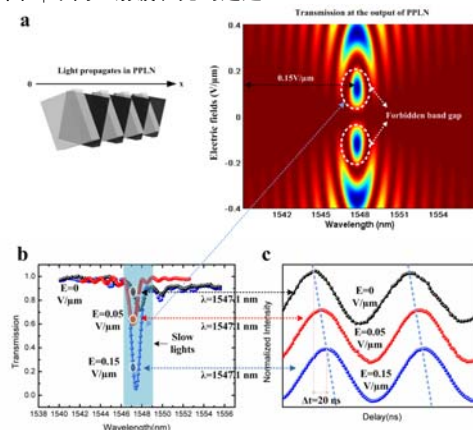


Figure 4 | Experimental results of the signal waveforms at different electric fields.

图4 | 不同外加电场下的延迟

The group velocity of a light near the filter band gap can be modulated from subluminal to superluminal by simply adjusting the applied external electric fields or wavelength.