WHAT IS CLAIMED IS:

1. An apparatus, comprising:

an optical path configured to propagate an input optical signal;

a plurality of electrodes configured to produce a plurality of discrete temporal phase shifts on said input optical signal, such that an output optical signal is phase-shifted with respect to said input optical signal by a sum of said plurality of discrete temporal phase shifts, wherein at least one temporal phase shift has a delay time with respect to another temporal phase shift.

2. The apparatus as recited in Claim 1, wherein each of said electrodes is associated with one of a respective plurality of portions of said optical path, each optical path portion having a different length.

3. The apparatus as recited in Claim 1, wherein said plurality of electrodes includes n electrodes configured to shift a phase of said input optical signal by any of 2^n different phase shift values.

4. The apparatus as recited in Claims 1, 2 or 3, wherein said plurality of electrodes are configured such that said sum has a maximum value less than about 2π radians.

5. A photonic matched filter, comprising:

a first optical arbitrary phase waveform generator adapted to accept a coherent light signal and apply a first temporal phase shift pattern thereto;

a second optical arbitrary phase waveform generator configurable to receive an output signal of said first

optical arbitrary phase waveform generator and apply a second temporal phase shift pattern thereto; and

a propagation path configured to propagate said coherent light signal from an output of said first waveform generator to an input of said second waveform generator.

6. The photonic matched filter as recited in Claim 5, wherein said first and second temporal phase shift patterns include a pseudo-random sequence of phase shift values.

7. The photonic matched filter as recited in Claim 5, wherein said first and second optical arbitrary phase waveform generators each include a plurality of electrodes associated with a corresponding plurality of optical path portions, each optical path portion having a length that is about twice as long as an optical path portion length of a next shorter optical path portion.

8. A method, comprising:

configuring an optical path to receive a coherent optical signal;

adapting a first plurality of electrodes to produce a first plurality of discrete phase shifts on said coherent signal, such that an output optical signal is phase-shifted with respect to said input optical signal by a sum of said plurality of discrete phase shifts; and

configuring a first phase sequence generator to control said first plurality of electrodes to produce a first temporal phase shift pattern on said coherent optical signal.

9. The method as recited in Claim 8, further comprising providing a second plurality of electrodes configured to produce a second plurality of discrete phase shifts on said coherent optical signal, and

configuring a second phase sequence generator to control said second plurality of electrodes to produce a second temporal phase shift pattern on said coherent optical signal.

10. The method as recited in Claim 9, wherein said second temporal phase shift pattern is delayed by a delay time with respect to said first temporal phase shift pattern, wherein said delay time is a value that results in a temporal correlation between said second temporal phase shift pattern and said first temporal phase shift pattern.

CLAIMS

1. An apparatus, comprising:

an optical path configured to propagate an input optical signal;

a plurality of electrodes configured to produce a plurality of discrete temporal phase shifts on said input optical signal, such that an output optical signal is phase-shifted with respect to said input optical signal by a sum of said plurality of discrete temporal phase shifts,

wherein at least one temporal phase shift has a delay time with respect to another temporal phase shift.

2. The apparatus as recited in Claim 1, wherein a first of said plurality of electrodes is configured to produce a first phase shift and a second of said plurality of electrodes is configured to produce a second phase shift that is about twice said first phase shift.

3. The apparatus as recited in Claim 1, wherein said plurality of electrodes includes at least six electrodes.

4. The apparatus as recited in Claim 1, wherein said plurality of electrodes are configured such that said sum has a maximum value less than about 2π radians.

5. The apparatus as recited in Claim 1, wherein each of said electrodes is associated with one of a respective plurality of portions of said optical path, each optical path portion having a different length.

6. The apparatus as recited in Claim 5, wherein each optical path portion has a length that is about twice as long as a path length of a next shorter optical path portion.

7. The apparatus as recited in Claim 1, wherein said plurality of electrodes includes *n* electrodes configured to shift a phase of said input optical signal by any of 2^n different phase shift values.

8. The apparatus as recited in Claim 7, wherein an incremental phase shift between any two subsequent phase shift values is about $\pi/2^{n-1}$ radians.

9. A photonic matched filter, comprising:

a first optical arbitrary phase waveform generator adapted to accept a coherent light signal and apply a first temporal phase shift pattern thereto;

a second optical arbitrary phase waveform generator configurable to receive an output signal of said first optical arbitrary phase waveform generator and apply a second temporal phase shift pattern thereto; and

a propagation path configured to propagate said coherent light signal from an output of said first waveform generator to an input of said second waveform generator.

10. The photonic matched filter as recited in Claim 9, wherein said propagation path includes a free-space path.

11. The photonic matched filter as recited in Claim 9, wherein said first and second temporal phase shift patterns are a same temporal phase shift pattern.

12. The photonic matched filter as recited in Claim 9, wherein said first and second temporal phase shift patterns include a pseudo-random sequence of phase shift values.

13. The photonic matched filter as recited in Claim 9, wherein said first and second optical arbitrary phase waveform generators each include a plurality of electrodes associated with a corresponding plurality of optical path portions, each optical path portion having a length that is about twice as long as an optical path portion length of a next shorter optical path portion.

14. The photonic matched filter as recited in Claim 9, wherein said first optical arbitrary phase waveform generator includes at least six electrodes configured to apply said first temporal phase shift pattern, and said second optical arbitrary phase waveform generator includes at least six electrodes configured to apply said second temporal phase shift pattern.

15. The photonic matched filter as recited in Claim 9, wherein said first and said second optical arbitrary phase waveform generators are each configured to produce 2^n unique phase shifts values, where n is a number of electrodes configured to change a phase of said coherent light signal.

16. The photonic matched filter as recited in Claim 15, wherein an incremental phase shift between any two subsequent phase shift values is about $\pi/2^{n-1}$ radians.

17. A method, comprising:

configuring an optical path to receive a coherent optical signal;

adapting a first plurality of electrodes to produce a first plurality of discrete phase shifts on said coherent signal, such that an output optical signal is phase-shifted with respect to said input optical signal by a sum of said plurality of discrete phase shifts; and

configuring a first phase sequence generator to control said first plurality of electrodes to produce a first temporal phase shift pattern on said coherent optical signal.

18. The method as recited in Claim 17, further comprising providing a second plurality of electrodes configured to produce a second plurality of discrete phase shifts on said coherent optical signal, and configuring a second phase sequence generator to control said second plurality of electrodes to produce a second temporal phase shift pattern on said coherent optical signal.

19. The method as recited in Claim 18, wherein said second temporal phase shift pattern is delayed by a delay time with respect to said first temporal phase shift pattern.

20. The method as recited in Claim 19, wherein said delay time is a value that results in a temporal correlation between said second temporal phase shift pattern and said first temporal phase shift pattern.

21. The method as recited in Claim 18, wherein said first temporal phase shift pattern and said second temporal phase shift pattern are a same temporal phase shift pattern.