CLAIMS:

1. A method for receiving and/or transmitting waveforms by two or more phased arrays, the method comprising:

i. applying a first coherent processing to two or more signal sets comprising signal portions being received or transmitted by corresponding two or more phased arrays (PAs) operating in respective receiving or transmitting modes, wherein said first coherent processing comprises converting the sets of signal portions being received into corresponding sets of directional signals or converting sets of directional signals into the sets of signal portions to be transmitted, said converting comprising coherent integrations of each set in one of the sets of signals portions or the sets of directional signals for obtaining the other one of said sets of signals portions and said sets of directional signals; each of the directional signals being indicative of the angular frequencies, amplitudes and phases of waveforms to be received or transmitted; and

ii. applying a second coherent processing to a coherent set of directional signals or to said two or more sets of the directional signals to perform the respective transmitting and receiving modes, wherein said second coherent processing of the transmitting and receiving modes comprises adjusting phases of respectively said coherent set of directional signals and said sets of the directional signals, the phase being adjusted in accordance with spatial dispositions between the PAs and the angular frequencies of the directional signals, the phase adjusting in the transmitting and receiving modes providing respectively the sets of the directional signals and the coherent set of directional signals,

thereby enabling to utilize said two or more PAs to carry out at least one of coherently receiving and coherently transmitting with improved gain of one or more waveforms propagating in one or more directions.

2. The method according to claim 1 configured for operating in receiving mode for determining one or more directions of propagation of an incoming waveform received by said arrangement of two or more PAs;

the method comprising simultaneously receiving incoming waveform by said two or more PAs and generating two or more sets of signal portions corresponding to said incoming waveform respectively received by said two or more phased arrays PAs; and

said first coherent processing comprising applying coherent integration to each of the two or more sets of signal portions for a given wavelength to obtain the two or more corresponding sets of directional signals;

said second coherent processing comprising adjusting the phases of the directional signals in said sets of directional signals in order to correct said phases by compensating over the spatial dispositions between the PAs thereby determining two or more phase adjusted sets of directional signals corresponding to said two or more PAs, and coherently adding corresponding directional signals which are associated with similar angular frequencies in said two or more phase adjusted sets of directional signals thereby determining one or more composite directional signals presenting said coherent set of directional signals, wherein each composite directional signal being indicative of an amplitude by which an incoming waveform with a particular angular frequency was received by the two or more PAs;

thereby enabling to utilize said two or more PAs to determine one or more directions of propagation of said incoming waveform with improved signal to noise ratio and improved angular resolution.

3. The method according to claim 1 configured for operating in transmitting mode for determining two or more sets of signal portions to be transmitted respectively by the elements of said two or more PAs for generating transmitted waveform propagating in one or more desired directions; the method comprising:

providing said coherent set of directional signals in which each directional signal being indicative of an amplitude and particular direction towards which a waveform signal should be transmitted by said two or more PAs; and

said second coherent processing comprising applying phase adjustment to directional signals in two or more replicas of said coherent set of directional for respectively generating said two or more sets of directional signals from said two or

more replicas, wherein said phase adjustment is adapted to correct the phases of the directional signals of each particular set of directional signals in accordance with spatial disposition of the PA respectively associated with the particular set of directional signals; and

said first coherent processing comprising applying coherent integration to each of the two or more sets of directional signals for respectively generating, for a given transmission wavelength, the two or more sets of signal portions and simultaneously providing said sets of signals portions to the elements of the respective PAs for transmitting said transmitted waveform towards said one or more desired directions of propagation with improved angular resolution and reduced sidelobes.

4. The method according to claim 2, further comprising comparing powers said composite directional signals with a predetermined criteria to determine, for at least one composite directional signal, whether it is indicative of an actual incoming waveform propagating from a particular direction corresponding to the angular frequency thereof or whether it is noise signal.

5. The method according to claim 1 wherein one or more of said PAs are configured as curved PAs, each including an array of elements arranged along a curved surface or line.

6. The method according to claim 1 wherein the elements of at least one PA are arranged in uniform spatial disposition defining fixed distances between them with respect to at least one axis; wherein at least one of the following:
said elements are arranged on said axis with said fixed distances between them; or
at least some of the elements are spaced from said axis and said fixed distance being the distance between projections of said at least some elements onto said axis.

7. The method according to claim 6 wherein the fixed distance between the elements of at least one PA of said two or more PAs is different from a fixed distance between the elements of other PA of said two or more PAs, such that the sets of

directional signals associated with said at least one PA and said other PA include signals from different groups of angular frequency bins; the method comprising interpolation of directional signals carried out in at least one of the following: (i) in receiving operational mode, said interpolation includes interpolating at least one set of the two or more sets of directional signals to thereby obtain, in said two or more sets of directional signals, directional signals indicative of the amplitudes and phases with respect to a common group of angular frequency bins with improved directional resolution; or (ii) in transmitting operational mode, said interpolation includes interpolating at least one set of two or more sets of directional signals, which are associated with a common group of angular frequency bins as resulted from said second coherent processing, to thereby obtain, the sets of directional signals which are associated with different groups of angular frequency bins set in accordance with the fixed distance between the elements of their respective PAs.

8. The method according to claim 7 wherein said first coherent processing and said interpolation are performed together utilizing a zero-padding fast-Fourier-transform algorithm.

9. The method according to claim 7 wherein interpolation of at least one set of directional signals comprises re-sampling the directional signals of said at least one set.

10. The method according to claim 6, wherein the fixed distances of said uniform spatial disposition between the elements of at least one PAs of said two or more PAs are greater than half said given wavelength thereby proving that at least one set of directional signals, which corresponds to said at least one PA and involved in said first coherent processing, is a folded set associated with directional ambiguity; the method comprising converting between said folded set and an unfolded set of directional signals, which is expressly indicative of said directional ambiguity, and utilizing said unfolded set of directional signals in said second coherent processing.

11. The method according to claim 1 wherein at least one PA of said the two or more PAs is not aligned with other PAs of said two or more PAs; the method comprising modifying at least one set of signal portions corresponding to said least one PA by co-phasing the signal portions of said at least one set of signal portions to compensate for misalignment between said at least one PA and said other PAs.

12. The method according to claim 1 wherein said first coherent processing is performed by applying a Fourier transform or an inverse thereof, based on said given wavelength, to convert between said two or more sets of signal portions and the two or more corresponding sets of directional signals.

13. The method according to claim 1 wherein in said second coherent processing, the phase of a directional signal associated with a particular PA is shifted by an amount corresponding to the phase delays incurred to a waveforms signal, which is received by said PA with an angular frequency indicated by said directional signal, due to disposition between said particular PA and other PAs.

14. A computer program product comprising a non-transitory computer readable medium having computer readable program code embodied therein and adapted for causing the computer to carry out the method of claim 1.

15. A system for receiving and/or transmitting waveforms by two or more phased arrays, the system comprising a signal processing utility connectable to the elements of two or more PAs and configured for operating in at least one of receiving and transmitting modes for applying signal processing to signals respectively received or transmitted by the elements of said two or more PAs said signal processing comprising:

i. applying a first coherent processing to two or more signal sets comprising signal portions being received or transmitted by corresponding two or more phased arrays operating in respective receiving or transmitting modes, wherein said first coherent processing comprises converting the sets of signal portions being received into corresponding sets of directional signals or converting sets of directional signals into the

sets of signal portions to be transmitted, said converting comprising coherent integrations of each set in one of the sets of signals portions or the sets of directional signals for obtaining the other one of said sets of signals portions and said sets of directional signals; each of the directional signals being indicative of the angular frequencies, amplitudes and phases of waveforms to be received or transmitted; and

ii. applying a second coherent processing to a coherent set of directional signals or to said two or more sets of the directional signals to perform the respective transmitting and receiving modes, wherein said second coherent processing of the transmitting and receiving modes comprises adjusting phases of respectively said coherent set of directional signals and said sets of the directional signals, the phase being adjusted in accordance with spatial dispositions between the PAs and the angular frequencies of the directional signals, the phase adjusting in the transmitting and receiving modes providing respectively the sets of the directional signals and the coherent set of directional signals,

the system thereby provides for utilizing said two or more PAs to carry out at least one of coherently receiving and coherently transmitting one or more waveforms propagating in one or more directions.

16. The system according to claim 15 configured for operating in receiving mode for determining one or more directions of propagation of an incoming waveform received by said arrangement of two or more PAs, wherein said processing utility is adapted to receive said two or more sets of signal portions of incoming signals, simultaneously received by said two or more PAs respectively;

the system comprises a PA coherent processing module adapted to carry out said first coherent processing by applying a first coherent integration to each of the two or more sets of signal portions based on a given wavelength to thereby obtain two or more corresponding sets of directional signals; and the system comprises a composite coherent processing module adapted for applying said second coherent processing to the two or more sets of the directional signals wherein said second coherent processing comprising adjusts the phases of the directional signals in said sets of directional signals in order to correct said phases by compensating over the spatial dispositions between

the PAs and thereby determining two or more phase adjusted sets of directional signals corresponding to said two or more PAs, and coherently adding one or more corresponding directional signals which are associated with similar angular frequencies in said two or more phase adjusted sets of directional signals

thereby determining one or more composite directional signals presenting said coherent set of directional signals, wherein each composite directional signal is indicative of an amplitude by which an incoming waveform with a particular angular frequency was received by the two or more PAs;

the system thereby provides for determining one or more directions of propagation of said incoming waveform with improved signal to noise ratio and improved angular frequency resolution.

17. The system according to claim 15 configured for operating in transmitting mode for determining two or more sets of signal portions to be respectively transmitted by the elements of said two or more PAs for generating transmitted waveform signals propagating in one or more desired directions; wherein said processing utility is adapted to obtain said coherent set of directional signals in which each signal being indicative of an amplitude and particular direction towards which a waveform signal should be transmitted by said two or more PAs; and

the system comprises a composite coherent processing module adapted for carrying out said second coherent processing by applying phase adjustment to directional signals in two or more replicas of said coherent set of directional signals for respectively generating said two or more sets of directional signals from said two or more replicas, wherein said phase adjustment is adapted to correct the phases of the directional signals of each particular set of directional signals in accordance with spatial disposition of the PA respectively associated with the particular set of directional signals; and

the system comprises a PA coherent processing module adapted for carrying out said first coherent processing by applying coherent integration to each of the two or more sets of directional signals for respectively generating, for a given transmission wavelength, the two or more sets of signal portions;

the processing utility is adapted to simultaneously provide said sets of signal portions to the elements of the respective PAs for causing transmission of said waveform signals towards said one or more desired directions of propagation with improved angular resolution and reduced sidelobes.

18. The system according to claim 16 wherein said coherent processing module is further adapted for further comparing powers of said composite directional signals with a predetermined criteria to determine, for at least one composite directional signal whether it is indicative of an actual incoming waveform propagating from a particular direction corresponding to the angular frequency of the directional signal or whether it is a noise signal.

19. The system according to claim 15, further comprising said two or more PAs; and wherein at least one of the following:

one or more of said PAs are configured as curved PAs, each including an array of elements arranged along a curved surface or line; and

at least one PA is associated with a uniform spatial disposition of its elements, said uniform spatial disposition being defined by a fixed distance between the elements along at least one axis, such that said elements are arranged in one or more of the following ways:

i) the elements are arranged on said axis with said fixed distances between them; or

ii) at least some of the elements are spaced from said axis and said fixed distance being the distance between projections of said at least some elements onto said axis.

20. The system according to claim 19 wherein said two or more PAs are configured such that distance between the elements of at least one PA of said two or more PAs is fixed and is different from a fixed distance between the elements of the other PA of said two or more PAs, such that the sets of directional signals are associated with different groups of angular frequency bins; and wherein the processing utility is operable for interpolating directional signals by carrying out at least one of the following: (i) in

receiving operational mode, interpolating at least one set of the two or more sets of directional signals to thereby obtain, in said two or more sets of directional signals, directional signals indicative of the amplitudes and phases with respect to a common group of angular frequency bins with improved directional resolution; or (ii) in transmitting operational mode, interpolating at least one set of two or more sets of directional signals, which are associated with a common group of angular frequency bins resulting from said second coherent processing, to thereby obtain the sets of directional signals which are associated with different groups of angular frequency bins set in accordance with the fixed distance between the elements of their respective PAs.

21. The system according to claim 15, wherein at least one PA of said two or more PAs is configured with a fixed distance between its elements which is greater than half said given wavelength, thereby providing that at least one set of directional signals, which corresponds to said at least one PA and involved in said first coherent processing, is a folded set of directional signals associated with directional ambiguity; the processing utility is adapted for converting between said folded set and an unfolded set expressly indicative of said directional ambiguity; and said composite coherent processing module is adapted for utilizing said unfolded set in said second coherent processing thereby resolving said directional ambiguity.

22. The system according to claim 15 wherein at least one PA of said the two or more PAs is not aligned with other PAs of said two or more PAs; the processing utility comprising a phase alignment module that is configured and operable for modifying at least one set of signal portions corresponding to said least one PA by co-phasing the signal portions of said at least one set of signal portions to compensate for misalignment between said at least one PA and said other PAs.

23. The system according to claim 22 wherein said at least one PA is at least one of a two dimensional PA not co-planarly aligned with said other PAs, a one dimensional PA not collinearly aligned with said other PAs, and a curved PA; and wherein said phase alignment module is configured and operable for respectively compensating over

a corresponding one of a coplanar- and collinear-misalignment and a curvature of said at least one PA.

24. The system according to claim 15 wherein in said second coherent processing, the phase of a directional signal associated with particular PA is shifted by an amount corresponding to the phase delays, which are incurred to a waveform, received or transmitted by said particular PA and having an angular frequency indicated by said directional signal, due to disposition between said particular PA and other PAs.