Claims:

1. System for determining a direction of low power radiation, said low power radiation originating from at least one source, said radiation arriving substantially collimated, the system comprising:

an opening, for receiving incoming radiation;

at least two radiation detectors, located at different spatial locations behind said opening, each said radiation detector detecting at least a respective portion of said incoming radiation, received from said opening and converting said respective portion of said incoming radiation into a respective electric signal;

for each said radiation detector, at least one respective integrator, coupled with said respective radiation detector, for integrating said respective electric signal;

a threat detector, for also receiving said incoming radiation and for determining if said at least one source is a threatening source, said threat detector producing a potential threat signal if said at least one source is suspected of being a potentially threatening source and a threat mode signal if said at least one source is determined to be a threatening source;

said threat detector comprising:

a radiation sensor, for detecting said incoming radiation and converting said incoming radiation into a corresponding electric signal;

a threshold detector, for determining an intensity level of said corresponding electric signal and producing said potential threat signal each time said intensity level exceeds a threshold level, said threshold detector being coupled with said radiation sensor, and

a counter, for counting the number of said potential threat signals, within a potential threat time period, said counter being coupled with said threshold detector;

the system further comprising:

a counter controller, coupled with said counter in said threat detector,

an integration enabler, coupled with said counter controller and with each of said at least two respective integrators; and

a processor, coupled with said at least two respective integrators and with said integration enabler,

wherein said counter provides said potential threat signal to said counter controller;

wherein said counter produces said threat mode signal and provides said threat mode signal to said counter controller, if the number of said counted potential threat signals, within said potential threat time period, exceeds a threat value;

wherein said counter controller provides said potential threat signal and said threat mode signal to said integration enabler;

wherein said integration enabler enables said at least two respective integrators for a particular amount of time each time said potential threat signal is received; and

wherein said processor determines said direction according to the integrated amounts of said respective electric signals integrated by said at least two respective integrators if said at least one source is determined to be a threatening source.

2. The system according to claim 1, further comprising:

a switch, coupled with said at least two radiation detectors and said at least two respective integrators, for directing said respective electric signal to a corresponding one of said at least two respective integrators;

a respective amplifier for each said radiation detector;

a respective diode for each of said respective integrators, each diode being respectively coupled with one of said respective amplifiers and with one of said respective integrators; and

a shutter, said shutter located in front of said opening,

wherein said integration enabler is coupled with each of said at least two respective integrators, via said at least two respective amplifiers, and

wherein said integration enabler is coupled with each of said at least two respective integrators via said shutter.

3. The system according to claim 1, wherein said processor determines said direction by subtracting said amount of said electric signal integrated by one of said respective integrators from said amount of said electric signal integrated by another one of said respective integrators, thereby producing a subtraction result, and normalizing said subtraction result by dividing said subtraction result by the sum of said amounts of said integrated electric signals.

4. The system according to claim 1, wherein said processor determines said direction by retrieving the direction corresponding to said amounts of said integrated electric signals in a normalized look-up table.

5. The system according to claim 1, said threat detector further comprising:

an optical filter, optically coupled with said radiation sensor, for filtering specified optical properties of said incoming radiation; and

at least one temporal filter, for filtering predetermined sets of electric signal characteristics corresponding to spatial encodings of said incoming radiation, said at least one temporal filter being coupled with said radiation sensor and said threshold detector.

6. The system according to claim 1, wherein said particular amount of time is selected from the list consisting of:

a variable amount of time depending on the characteristics of said incoming radiation;

a predetermined amount of time; and

a duration of time said incoming radiation is above said threshold level.

7. The system according to claim 1, wherein said processor determines said direction only when said threat detector produces said threat mode signal.

8. The system according to claim 1, wherein said respective integrators are reset if a predetermined threshold is reached.

9. The system according to claim 8, wherein said predetermined threshold is selected from the list consisting of: the signal saturation value of said respective integrators and the amount of time said apparatus would require to identify a change in direction of said radiation.

10. The system according to claim 5, said threat detector further comprising a day-night sensor, for detecting the presence or absence of sunlight.

11. Method for determining the direction of low power incoming radiation, said low power incoming radiation originating from at least one source, said incoming radiation arriving substantially collimated, comprising the procedures of:

receiving said incoming radiation through an opening onto at least two radiation detectors, said radiation detectors located behind said opening, said radiation detectors configured to each receive different amounts of said incoming radiation for different directions of said incoming radiation;

providing said incoming radiation on said at least two radiation detectors as respective electric signals;

filtering said incoming radiation;

converting said filtered incoming radiation as a corresponding electric signal;

determining an intensity level of said corresponding electric signal corresponding to the filtered incoming radiation;

producing a potential threat signal each time said intensity level of said corresponding electric signal corresponding to the filtered incoming radiation exceeds a threshold level, said potential threat signal being produced for a particular amount of time;

integrating each of said respective electric signals, thereby producing a respective integrated amount of incoming radiation, said integrating commencing upon receiving said potential threat signal;

determining if said incoming radiation originated from a threatening source according to a number of said potential threat signals produced in a potential threat time period; and

determining a direction for said incoming radiation, if said incoming radiation originated from a threatening source, by comparing said respective integrated amounts of incoming radiation impinging upon said at least two radiation detectors.

12. The method according to claim 11, wherein said comparing comprises subtracting said respective integrated amount of radiation impinging on one of said at least two radiation detectors from said respective integrated amount of radiation impinging upon the other of said at least two radiation detectors, thereby producing a subtraction result, wherein said subtraction result is normalized by dividing said subtraction result by the sum of said respective integrated amounts of radiation impinging on said at least two radiation detectors, thereby determining said direction of said incoming radiation.

13. The method according to claim 11, wherein said comparing comprises looking up, in a normalized look-up table, said respective integrated amounts of radiation impinging upon each of said at least two radiation detectors, thereby determining said direction of said incoming radiation.

14. The method according to claim 11, wherein said particular amount of time is selected from the list consisting of:

a variable amount of time depending on the characteristics of said incoming radiation;

a predetermined amount of time; and

a duration of time said incoming radiation is above said threshold level.

15. The method according to claim 11, wherein said threshold level is determined according to a sub-procedure selected from the list consisting of:

setting said threshold level above a proportional multiplication of the intensity level of a noise signal;

calculating said threshold level by applying a probability model for false alarms to a single pulse of said incoming radiation; and

calculating said threshold level according to field tests in broad daylight.

16. The method according to claim 11, further comprising the procedure of keeping said threshold level constant.

17. The method according to claim 11, further comprising the procedure of varying said threshold level according to the time of day during which said method is used.

18. The method according to claim 11, further comprising the procedure of resetting said respective integrated amount of incoming radiation if a predetermined threshold is reached.

19. The method according to claim 18, wherein said predetermined threshold is selected from the list consisting of: the signal saturation value of said respective integrated amount of incoming radiation and the amount of time required to identify a change in the direction of said incoming radiation.

CLAIMS

1. Apparatus for detecting the presence of low power radiation, said low power radiation originating from at least one source, the apparatus comprising:

a radiation sensor, for detecting incoming radiation and converting said incoming radiation into a corresponding electric signal;

a threshold detector, coupled with said radiation sensor, for producing a potential threat indication each time said electric signal exceeds a threshold level; and

a counter, coupled with said threshold detector, for counting the number of said potential threat indications, within a potential threat time period,

wherein said counter produces a threat indication, if the number of said counted potential threat indications, within said potential threat time period, exceeds a threat value.

2. The apparatus according to claim 1, further comprising an optical filter, optically coupled with said radiation sensor, for filtering specified optical properties of said incoming radiation.

3. The apparatus according to claim 2, wherein said optical properties comprise specified wavelengths of said incoming radiation.

4. The apparatus according to claim 2, wherein said optical properties comprise specified polarizations of said incoming radiation.

5. The apparatus according to claim 3, wherein said specified wavelengths include wavelengths associated with laser guided weapons.

6. The apparatus according to claim 1, wherein said threshold level is set above a proportional multiplication of the intensity level of a noise signal.

7. The apparatus according to claim 1, wherein said threshold level is calculated by applying a probability model for false alarms to a single pulse of said incoming radiation.

8. The apparatus according to claim 1, wherein said threshold level is determined by exposing said radiation sensor to broad daylight.

9. The apparatus according to claim 1, wherein said threshold level varies according to the time of day said apparatus is used.

10. The apparatus according to claim 1, further comprising a controller, coupled with said counter, for resetting said counter after each said potential threat time period.

11. The apparatus according to claim 1, wherein said threat value is substantially determined using the following equation:

$$P(D) = \sum_{j=m}^{n} q^{j} \cdot (1-q)^{n-j} \frac{n!}{j!(n-j)!}$$

wherein $P(D)$ defines the overall probability that said detected incoming radiation originated from a threatening source,

wherein q defines the probability that an individual one of said potential threat indications, which actually corresponds to said detected incoming radiation originating from a threatening source, will be at or above said threshold level,

wherein q is determined by a probability model for false alarms applied to a single pulse of said incoming radiation,

wherein j is an index number,

wherein m defines said threat value, and

wherein n defines the maximum number of times said incoming radiation is verified, in said potential threat time period, to determine if said potential threat indication will be produced.

12. The apparatus according to claim 11, wherein said threat value is lowered as $P(D)$ increases.

13. The apparatus according to claim 12, wherein said counter determines the modulation frequency of said radiation, when said threat value is lowered, by dividing said threat value by the duration of time it takes said counter to produce said threat indication.

14. The apparatus according to claim 1, further comprising at least one temporal filter, coupled with said radiation sensor and said threshold detector, for filtering predetermined sets of electric signal characteristics corresponding to spatial encodings of said incoming radiation.

15. The apparatus according to claim 14, wherein said at least one temporal filter is coupled with said threshold detector and said counter.

16. The apparatus according to claim 14, wherein one of said at least one temporal filter comprises a band pass filter.

17. The apparatus according to claim 14, further comprising a demultiplexer, coupled with said radiation sensor and said temporal filter, for directing said electric signal to the appropriate one of said at least one temporal filter corresponding to the spatial encoding of said incoming radiation.

18. The apparatus according to claim 2, further comprising a day-night sensor, coupled with said optical filter, for detecting the presence or absence of sunlight.

19. The apparatus according to claim 1, for determining a direction of said low power radiation, said radiation arriving substantially collimated, further comprising:

an opening, for receiving said incoming radiation;

at least two direction radiation sensors, located at different spatial locations behind said opening, each said direction radiation sensor detecting at least a respective portion of said incoming radiation, received from said opening and converting said respective portion of said incoming radiation into a respective direction electric signal;

for each said direction radiation sensor, at least one respective integrator, coupled with said respective direction radiation sensor, for integrating said respective direction electric signal;

an integration enabler, coupled with each of said at least two respective integrators; and

a processor, coupled with said integrators and said counter, for determining said direction according to the amounts of said direction electric signals integrated by said integrators.

20. The apparatus according to claim 19, further including a switch, coupled with said at least two direction radiation sensors and said at least one respective integrator, for directing said respective direction electric signal to a corresponding one of said at least one respective integrator.

21. The apparatus according to claim 19, wherein said incoming radiation impinges upon each of said at least two direction radiation sensors.

22. The apparatus according to claim 19, wherein said integration enabler is coupled with each of said at least two respective integrators via said respective direction radiation sensors.

23. The apparatus according to claim 19, wherein said processor comprises an analog-to-digital converter.

24. The apparatus according to claim 19, wherein said processor determines said direction by subtracting said amount of said direction electric signal integrated by one of said respective integrators from said amount of said direction electric signal integrated by another of said respective integrators, thereby producing a subtraction result.

25. The apparatus according to claim 24, wherein said subtraction result is normalized by dividing said subtraction result by the sum of said amounts of said direction electric signals integrated.

26. The apparatus according to claim 19, wherein said processor determines said direction by retrieving the direction corresponding to said amounts of said direction electric signals integrated in a normalized look-up table.

27. The apparatus according to claim 19, wherein said processor resets said counter if the sum of said at least respective portion of said incoming radiation, detected by said at least two direction radiation sensors, is less than a predetermined intensity threshold level.

28. The apparatus according to claim 19, wherein said processor resets said counter if an insufficient number of said potential threat indications are counted in a predetermined amount of time.

29. The apparatus according to claim 19, wherein said processor resets said counter if said incoming radiation is only detected by one of said at least two direction radiation sensors.

30. The apparatus according to claim 19, further comprising a respective amplifier for each said direction radiation sensor.

31. The apparatus according to claim 30, wherein said integration enabler is coupled with each of said at least two respective integrators via said at least two respective amplifiers.

32. The apparatus according to claim 30, further comprising a respective diode for each of said respective integrators, each diode being respectively coupled with one of said respective amplifiers and with one of said respective integrators.

33. The apparatus according to claim 19, further comprising a shutter, said shutter located in front of said opening.

34. The apparatus according to claim 33, wherein said integration enabler is coupled with each of said at least two respective integrators via said shutter.

35. The apparatus according to claim 19, wherein said integration enabler enables said respective integrators for a predetermined amount of time each time said threshold detector produces said potential threat indication.

36. The apparatus according to claim 35, wherein said predetermined amount of time depends on the characteristics of said radiation.

37. The apparatus according to claim 19, wherein said processor determines said direction only when said counter produces said threat indication.

38. The apparatus according to claim 19, wherein said respective integrators are reset if a predetermined threshold is reached.

39. The apparatus according to claim 38, wherein said predetermined threshold is selected from the list consisting of:

the signal saturation value of said respective integrators, and

the amount of time said apparatus would require to identify a change in direction of said radiation.

40. Method for detecting the presence of low power incoming radiation, said low power radiation originating from at least one source, comprising the procedures of:

converting said incoming radiation into a corresponding electric signal;

determining an intensity level of said corresponding electric signal;

producing a potential threat indication each time said electric signal exceeds a threshold level;

counting the number of said potential threat indications, within a potential threat time period; and

producing a threat indication, if the number of said counted potential threat indications, within said potential threat time period, exceeds a threat value.

41. The method according to claim 40, wherein said threshold level is set above a proportional multiplication of the intensity level of a noise signal.

42. The method according to claim 40, wherein said threshold level is calculated by applying a probability model for false alarms to a single pulse of said incoming radiation.

43. The method according to claim 40, wherein said threshold level is calculated by field tests in broad daylight.

44. The method according to claim 40, wherein said threshold level is constant.

45. The method according to claim 40, wherein said threshold level is varied according to the time of day said method is used.

46. The method according to claim 40, further comprising the procedure of optically filtering said radiation according to at least one optical property of said incoming radiation.

47. The method according to claim 46, wherein said at least one optical property is selected from the list consisting of: specified wavelengths of said incoming radiation and specified polarizations of said incoming radiation.

48. The method according to claim 47, wherein said specified wavelengths include wavelengths associated with laser guided weapons.

49. The method according to claim 40, further comprising the procedure of resetting said counted number of potential threat indications after said potential threat time period.

50. The method according to claim 40, further comprising the procedure of temporally filtering said incoming radiation according to predetermined sets of electric signal characteristics corresponding to spatial encodings of said incoming radiation.

51. The method according to claim 40, wherein said threat value is substantially determined using the following equation:

$$P(D)=\sum_{j=m}^{n} q^{j}\cdot(1-q)^{n-j}\frac{n!}{j!\cdot(n-j)!}$$

wherein $P(D)$ defines the overall probability that said detected incoming radiation originated from a threatening source,

wherein q defines the probability that an individual one of said potential threat indications, which actually corresponds to said detected incoming radiation originating from a threatening source, will be at or above said threshold level,

wherein q is determined by a probability model for false alarms applied to a single pulse of said incoming radiation,

wherein j is an index number,

wherein m defines said threat value, and

wherein n defines the maximum number of times said radiation is verified, in said potential threat time period, to determine if said potential threat indication will be produced.

52. The method according to claim 51, wherein q is determined by field tests in broad daylight.

53. The method according to claim 52, further comprising the procedure of determining the modulation frequency of said radiation.

54. The method according to claim 53, wherein said procedure of determining consists of lowering said threat value as $P(D)$ increases, and dividing said threat value by the duration of time it takes to produce said threat indication.

55. The method according to claim 40, further comprising the procedure of detecting the presence or absence of sunlight.

56. The method according to claim 40, for determining the direction of said incoming radiation, said incoming radiation arriving essentially collimated, further comprising the procedures of:

receiving said incoming radiation through an opening onto at least two radiation detectors, said radiation detectors located behind said opening, said radiation detectors configured to each receive different amounts of said incoming radiation for different directions of said incoming radiation;

providing said incoming radiation on said at least two radiation detectors as respective direction electric signals;

integrating each of said respective direction electric signals, thereby producing a respective integrated amount, said integrating commencing upon receiving said potential threat indication; and

determining a direction for said incoming radiation, upon receiving said threat indication, by comparing said respective amounts of incoming radiation impinging upon said at least two radiation detectors.

57. The method according to claim 56, wherein said comparing comprises subtracting said respective amount of radiation impinging on one of said at least two radiation detectors from said respective amount of radiation impinging upon the other of said at least two radiation detectors, thereby producing a subtraction result,

wherein said subtraction result is normalized by dividing said subtraction result by the sum of said respective amounts of radiation impinging on said at

least two radiation detectors, thereby determining said direction of said incoming radiation.

58. The method according to claim 56, wherein said comparing comprises looking up, in a normalized look-up table, said respective amounts of radiation impinging upon each of said at least two radiation detectors, thereby determining said direction of said radiation.

59. The method according to claim 56, further comprising the procedure of resetting said integrated amount if a predetermined threshold is reached.

60. The method according to claim 59, wherein said predetermined threshold is selected from the list consisting of:

the signal saturation value of said integrated amount, and

the amount of time required to identify a change in the direction of said radiation.

61. The apparatus according to any of the claims 1-39 substantially as described hereinabove or as illustrated in any of the drawings.

62. The method according to any of the claims 40-60 substantially as described hereinabove or as illustrated in any of the drawings.