CLAIMS

1. A night vision system for imaging an object, the system being configured for operating at or near room temperature and in the wavelength region up to 2.5 microns, the system comprising:

a photodetector having a cut-off wavelength of up to 2.5 microns under said room temperature, and sensitive to both reflective radiation and thermal radiation emitted from the object;

an optical system configured for collecting light and focusing the collected light onto the photodetector; and

a controllably variable spectral filter located in an optical path of light propagating toward the photodetector, wherein said controllably variable spectral filter has a cut-off wavelength changing along at least one dimension of the filter, said cut-off wavelength changing including at least one of gradual changing and changing in discrete steps), said controllably variable filter being thereby configured and operable to controllably vary the cut-off wavelength thereof to selectively filter out light of wavelengths shorter than a predetermined value, at which the reflective radiation being dominant over the thermal radiation, thereby gradually shifting so as to shift operation of the night vision system from mostly reflection mode to a combined reflection and thermal mode, thereby to allow the night vision system to detect light reflected from and emitted by the object being imaged.

2. The night vision system of claim 1, wherein the photodetector is an extended SWIR sensor having a p-i-n structure.

3. The night vision system of claim 1, wherein the photodetector is a detection array comprising a doped InP substrate layer and a photodiode structure supported by the substrate InP layer, said photodiode structure comprising an n-type layer, a p-type layer, and an absorption layer being sensitive to light, and located between the n and the p layers.

4. The night vision system of claim 3, wherein the n-type layer is Si-doped InGaAs buffer layer deposited on the InP substrate layer; wherein the n-type layer is undoped InGaAs cap layer; and wherein the absorption layer is undoped InGaAs.

5. The night vision system of claim 3, wherein the absorption layers is a Strained Super Lattice (SLS) layer including 250 pair InGaAs(5 nm)/GaAsSb(5 nm) multi quantum well structures.

6. The night vision system of claim 3, wherein the absorption layers is a Strained Super Lattice (SLS) layer including three superlattice layers **SL1**, **SL2** and **SL3** grown on the InP substrate layer, wherein the **SL1** superlattice layer includes: 500 periods of $In_{0.53}Al_{0.47}As$ forming the cladding, 1500 periods of $In_{0.52}Al_{0.48}As$ forming the multiplication, 110 periods of $In_{0.52}Al_{0.48}As$ forming the charging sheet, 50 periods of InAlGaAs forming the grading; the **SL2** superlattice layer includes: 50 periods of $In_{0.53}Ga_{0.47}As$ and 1500 periods of 5 mm $In_{0.53}Ga_{.047}As$/5 mm $GaAs_{0.51}Sb_{0.40}$ forming the absorber; and the **SL3** superlattice layer includes: 45 periods of $In_{0.53}Ga_{0.47}As$ and 500 periods of $In_{0.53}Ga_{0.47}As$ forming the cladding and 20 periods of $In_{0.53}Ga_{0.47}As$ forming a contact.

7. The night vision system of claim 1, wherein the spectral filter is arranged upstream of the optical system.

8. The night vision system of claim 1, wherein the spectral filter is arranged downstream of the optical system.

9. The night vision system of claim 1, wherein said spectral filter is configured and operable to selectively filter out light of wavelengths predetermined value of the light wavelength shorter than which is filter out is about 1.8 microns.

10. The night vision system of claim 1, wherein the optical system has a first optical path through which a first wavelength band light generated by a thermal source is transmitted, and a second optical path through which a second wavelength band environmental light reflected from objects is transmitted, wherein the optical system is configured to modify optical characteristics of the light transmitted through

the first and second paths such that the light transmitted through the first path do not interfere with light transmitted through the second paths.

11. The night vision system of claim 3, wherein the absorption layers is a Strained Super Lattice (SLS) layer including multiple pair InGaAs(5 nm)/GaAsSb(5 nm) quantum well structures.

12. The night vision system of claim 3, wherein the absorption layers is a Strained Super Lattice (SLS) layer including three superlattice layers SL**1**, SL**2** and SL**3** grown on the InP substrate layer, wherein the SL**1** superlattice layer includes: multiple periods of $In_{0.53}Al_{0.47}As$ forming the cladding, multiple periods of $In_{0.52}Al_{0.48}As$ forming the multiplication, multiple periods of $In_{0.52}Al_{0.48}As$ forming the charging sheet, multiple periods of InAlGaAs forming the grading; the SL**2** superlattice layer includes: multiple periods of $In_{0.53}Ga_{0.47}As$ and multiple periods of 5 mm $In_{0.53}Ga_{0.47}As$/5 mm $GaAs_{0.53}Sb_{0.40}$ forming the absorber; and the SL**3** superlattice layer includes: multiple periods of $In_{0.53}Ga_{0.47}As$ and multiple periods of $In_{0.53}Ga_{0.47}As$ forming the cladding and multiple periods of $In_{0.53}Ga_{0.47}As$ forming a contact.

13. The night vision system of claim 1, wherein said spectral variable filter is a linear variable filter having the wavelength cut-off gradually changing along a linear dimension of the filter.

14. The night vision system of claim 13, wherein said spectral variable filter is configured as a stack of thin films.

15. The night vision system of claim 1, wherein said spectral variable filter has long wavelength cut-off at least in the range of 1700 nm to 2500 nm.

16. The night vision system of claim 1, wherein said spectral variable filter is configured as a circular variable filter having the wavelength cut-off gradually changing along a perimeter of a circle shape.

17. The night vision system of claim 1, wherein said spectral variable filter is configured such that the wavelength cutoff is changing in the discrete steps

along at least one of a linear dimension of the filter and a perimeter of a circle shape of the filter.

18. A method for imaging an object at or near room temperature and operating in the wavelength region up to 2.5 microns, the method comprising:

collecting light and focusing the collected light by an optical system onto a photodetector having a cut-off wavelength of up to 2.5 microns under said room temperature and sensitive to both reflective radiation and thermal radiation emitted from the object; and

selectively filtering out light of wavelengths at which the reflective radiation being dominant over the thermal radiation, by operating a controllably variable spectral filter, having a cut-off wavelength changing along at least one dimension of the filter, shorter than a predetermined value, thereby gradually shifting so as to shift imaging from mostly reflection mode to a combined reflection and thermal mode, thereby to allow detecting light reflected from and emitted by the object being imaged.

19. The method of claim 18, wherein the light which is filtered out has said predetermined value of the light wavelength shorter than the wavelength which is filtered out is about 1.8 microns.

20. The method of claim 18, wherein in the dark current of the photodetector is lower than 40 nA/cm^2.

21. The method of claim 18, wherein the photodetector operates at temperatures higher than 270K.

22. The method of claim 18, utilized for detecting firing or firearms.