NEP is comparable to that of the most sensitive direct detector of infrared radiation, even though the thermal conductance is more than 10 times larger.

TABLE 1

Detector parameters and performance.

Detector	Absorber	E	ΔE_{FWHM}	τ_{eff}
1	250 μm × 250 μm × 2 μm Ag film	4.5 keV x-ray	14 eV	480 μs
2	250 μm × 250 μm × 0.5 μm Ag film	1 keV heat pulse	2.6 eV	800 μs
3	100 μm × 70 μm × 50 nm Ag/Al bilayer	4 eV heat pulse	0.2 eV	8 μs

We claim:

1. A particle detector adapted for cryogenic use, comprising:

a particle absorber; and

a transition-edge sensor thermally coupled with said particle absorber, said transition-edge sensor comprising:

a substrate;

an aluminum/normal-metal bilayer disposed on said substrate, said bilayer comprising a first aluminum layer in contact with a first normal-metal layer, said bilayer having a superconducting state, a normal-conducting state and a transition region therebetween with transition temperature T_c; and

a means for measuring superconducting transitions within said transition region.

2. The particle detector of claim **1** wherein said normal-metal layer is disposed on said substrate.

3. The particle detector of claim **1** wherein T_c<1 K.

4. The particle detector of claim **3** wherein T_c<150 mK.

5. The particle detector of claim **1** wherein said normal metal is selected from the group consisting of gold, silver, copper, palladium, platinum, gold/copper alloy and palladium/copper alloy.

6. The particle detector of claim **1** wherein said means for measuring superconducting transitions comprises a means for applying a voltage bias to said bilayer and a means for measuring current through said bilayer.

7. The particle detector of claim **6** wherein said means for applying a voltage bias further functions as a means for providing electrothermal feedback to said bilayer.

8. The particle detector of claim **6** further comprising a heat pulse generator coupled with said absorber.

9. The particle detector of claim **1** wherein said means for measuring a superconducting transition comprises a means for applying a current bias to said bilayer and a means for measuring the voltage across said bilayer.

10. The particle detector of claim **1** wherein said means for measuring superconducting transitions comprises a coil around said bilayer.

11. The particle detector of claim **1** wherein said particle absorber comprises a normal metal.

12. The particle detector of claim **1** wherein said particle absorber is positioned adjacent to and in electrical and thermal contact with said bilayer.

13. The particle detector of claim **1** wherein said particle absorber is disposed on said bilayer.

14. The particle detector of claim **1** further comprising a second normal-metal layer and a second aluminum layer, said second layers disposed on said first layers with alternating aluminum and normal-metal layers.

15. A method of detecting particles, comprising the steps of:

providing a transition-edge sensor comprising:

a substrate;

an aluminum/normal-metal bilayer disposed on said substrate, said bilayer comprising a first aluminum layer in contact with a first normal-metal layer, said bilayer having a superconducting state, a normal-conducting state and a transition region therebetween with transition temperature T_c; and

a means for measuring superconducting transitions within said transition region;

maintaining the temperature of said bilayer within said transition region;

impinging a particle on said bilayer or on a particle absorber coupled with said bilayer;

measuring the resulting superconducting transition within said transition region of said bilayer; and

detecting said particle from said measured superconducting transition.

16. The method of claim **15** wherein said means for measuring superconducting transitions comprises a means for applying a voltage bias to said bilayer and a means for measuring current through said bilayer.

17. The method of claim **16** wherein the step of maintaining the temperature of said bilayer comprises the steps of cooling said bilayer while applying said voltage bias to said bilayer, thereby providing electrothermal feedback.

18. The method of claim **17** wherein said particle is an x-ray and wherein 50 mK<T_c<150 mK.

19. The method of claim **18** wherein said particle absorber comprises a normal metal and wherein said particle absorber is positioned adjacent to and in electrical and thermal contact with said bilayer.

20. The method of claim **15** wherein said particles impinge on said bilayer.

21. The method of claim **20** wherein said bilayer is narrow and meandering in shape.

22. A thermometer for measuring temperature changes in an object, comprising:

a transition-edge sensor adapted to be thermally coupled with said object, said transition-edge sensor comprising:

a substrate;

an aluminum/normal-metal bilayer disposed on said substrate, said bilayer comprising a first aluminum layer in contact with a first normal-metal layer, said bilayer having a superconducting state, a normal-conducting state and a transition region therebetween with transition temperature T_c; and

a means for measuring temperature changes in said object comprising a means for measuring superconducting transitions within said transition region.

23. The thermometer of claim **22** wherein said bilayer has a graded thickness.

24. A method for regulating the temperature of an object, comprising the steps of:

providing the thermometer of claim **22**;

thermally coupling said object to said bilayer; and

maintaining the temperature of said bilayer within said transition region by cooling said bilayer while applying a voltage to said bilayer, thereby providing electrothermal feedback.

25. The thermometer of claim **22** wherein said object is a particle absorber, whereby said thermometer detects particles striking said absorber.