CLAIMS

1. A scintillator material comprising a composition of Formula (III):

$$[(Lu_{1-x}Y_x)_{1-y-z}A_yB_z]_3Al_5O_{12} \quad \text{(III)},$$

wherein:

$0.05 \leq x \leq 0.5$;

$0.0001 \leq y \leq 0.015$;

$0.0002 \leq z \leq 0.1$;

A is Pr^{3+}; and

B is at least one type of monovalent cation selected from the group consisting of Li, Na, and K.

2. The scintillator material of claim 1, wherein $0.1 \leq x \leq 0.5$, optionally wherein x is 0.25.

3. The scintillator material of claim 1 or claim 2, wherein y is 0.004 or 0.012.

4. The scintillator material of any one of claims 1-3, wherein B is a monovalent cation of a lithium isotope or a mixture thereof, optionally wherein B is a monovalent cation of a lithium-6 isotope (i.e., $^6Li^+$).

5. The scintillator material of any one of claims 1-4, wherein $0.001 \leq z \leq 0.1$, further optionally wherein z is 0.002, 0.008, or 0.02.

6. The scintillator material of any one of claims 1-5, wherein the scintillator material comprises a material selected from the group consisting of $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 0.2%Li^+, $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 0.8% Li^+, $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 2.0% Li^+; $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:1.2%$Pr^{3+}$ codoped with 0.308 at% Na^+, $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:1.2%$Pr^{3+}$ codoped with 0.6 at% Li^+, $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:1.2%$Pr^{3+}$ codoped with 0.6 at% K^+,

$(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:1.2%$Pr^{3+}$ codoped with 2.4 at% Li^+, and $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:1.2%$Pr^{3+}$ codoped with 6 at% Li^+, optionally wherein the material is selected from the group consisting of $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 0.2%Li^+, $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 0.8% Li^+, and $(Lu_{0.75},Y_{0.25})_3Al_5O_{12}$:0.4%$Pr^{3+}$ codoped with 2.0% Li^+.

7. The scintillator material of any one of claims 1-6, wherein the scintillator material is a single crystal material or a polycrystalline or a ceramic material.

8. A radiation detector comprising a photon detector and a scintillation material of any one of claims 1-7.

9. The radiation detector of claim 8, wherein the detector is a medical diagnostic device, a device for oil exploration, or a device for container or baggage scanning.

10. The use of the radiation detector of claim 8 for the detection of gamma rays, X-rays, cosmic rays and/or particles having an energy of 1 keV or greater, or for the detection of neutrons.

11. A method of preparing a scintillator material of any one of claims 1-7, wherein the method comprises pulling a single crystal from molten raw materials.

12. A method of altering one or more scintillation and/or optical properties of a rare earth aluminum garnet scintillator, wherein the rare earth aluminum garnet scintillator is a praseodymium (Pr) doped lutetium yttrium aluminum garnet (LuYAG) scintillator, wherein the method comprises preparing the rare earth aluminum garnet scintillator in the presence of a monovalent codopant ion, thereby providing a codoped rare earth aluminum garnet scintillator material, wherein the monovalent codopant ion is an alkali metal ion, optionally wherein the monovalent codopant ion is Li^+.