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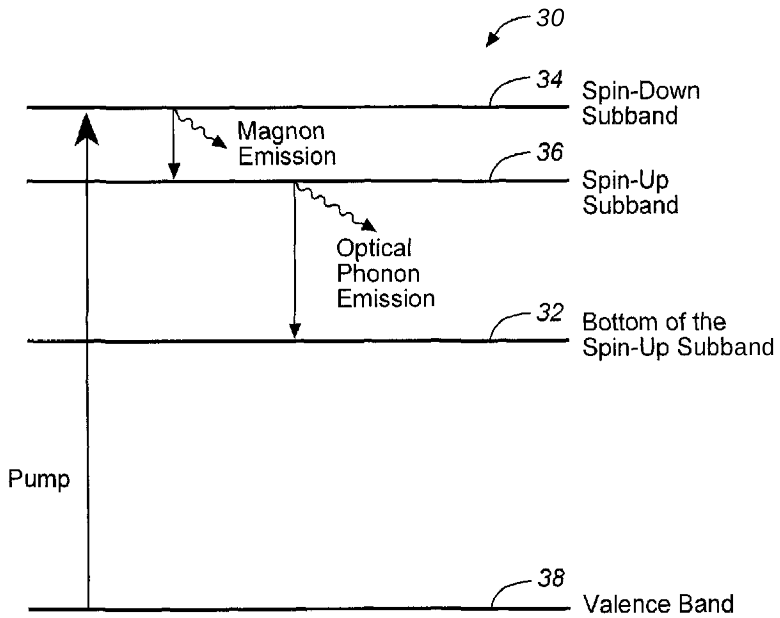
Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(U))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Ui))*

[Continued on next page]

(54) Title: GENERATION OF TERAHERTZ WAVES



(57) **Abstract:** A method of THz photon generation comprising: providing a magnon gain medium; wherein the magnon gain medium supports generation of nonequilibrium magnons; and injecting nonequilibrium electrons into the magnon gain medium. Propagation of nonequilibrium electrons in the magnon gain medium causes generation of nonequilibrium magnons. Interaction between nonequilibrium magnons causes generation of THz photons.

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AMENDED CLAIMS

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1. (Original) A method of photon generation comprising:

(A) providing a magnon gain medium; wherein said magnon gain medium supports generation of nonequilibrium magnons;

and

(B) generating said nonequilibrium magnons in said magnon gain medium; wherein interaction between said nonequilibrium magnons causes generation of photons.

2. (Currently amended) The method of claim 1, wherein said step (A) further comprises:

(Al) placing said magnon gain medium in a thermostat to maintain temperature of said magnon gain medium below a critical Curie temperature.

3. (Currently amended) The method of claim 1, wherein said step (A) further comprises:

(A2) selecting said magnon gain medium from the group consisting of: {ferromagnetic semiconductor; ferromagnetic isolator; and ferromagnetic material}.

4. (Currently amended) The method of claim 3, wherein said step (A2) further comprises:

(A2, 1) placing said magnon gain medium comprising said selected ferromagnetic material in said thermostat to maintain temperature of said selected ferromagnetic material below its Curie temperature.

5. (Original) The method of claim 1, wherein said step *(B)* further comprises:

(Bl) injecting nonequilibrium electrons into said magnon gain medium; wherein propagation of said nonequilibrium electrons in said magnon gain medium causes generation of said nonequilibrium magnons; and wherein interaction between said nonequilibrium magnons causes generation of photons.

6. (Original) The method of claim 5, wherein said step (Bl) further comprises:

(Bl, 1) pumping nonequilibrium electrons into said magnon gain medium.

7. (Original) The method of claim 5, wherein said step (Bl) further comprises:

(Bl, 2) pumping polarized nonequilibrium electrons into said magnon gain medium.

8. (Original) The method of claim 5, wherein said step (Bl) further comprises:

(Bl, 3) pumping substantially sufficient number of polarized nonequilibrium electrons into said magnon gain medium to cause generation of said nonequilibrium magnons in said magnon gain medium.

9. (Original) The method of claim 5, wherein said step (Bl) further comprises:

(Bl, 4) pumping a threshold number of polarized nonequilibrium electrons into said magnon gain medium, wherein said threshold number of pumped polarized nonequilibrium electrons is substantially sufficient to generate a magnon avalanche effect in said magnon gain medium.

10. (Currently amended) The method of claim 5, wherein said step (Bl) further comprises:

(Bl , 5) changing a maximum frequency of said generated photons by changing a magnon stiffness D; wherein said magnon stiffness D depends on critical Curie temperature of said magnon gain medium; and wherein critical Curie temperature of said raagnon gain medium depends on a concentration of impurities in said magnon gain medium.

H . (Original) The method of claim 5, wherein said step (Bl) further comprises:

(Bl, 6) changing an operating frequency of said generated photons; wherein said operating frequency of said generated photons depends on an external parameter; and wherein said external parameter is selected from the group consisting of: {energy of said injected electrons; and an operating temperature of said thermostat}.

12. (Original) The method of claim 1, wherein said step (B) further comprises:

(B2) generating THz photons by using a merging process between said nonequilibrium magnons in said magnon gain medium.

13. (Currently amended) The method of claim 1 further comprising:

(C) manipulating reflection coefficient of surface area of said magnon gain medium by using reflective and transmission means attached to said surface area of said magnon gain medium to manipulate the number of photons being reflected by said surface area of said magnon gain medium.

14. (Original) The method of claim 13, wherein said step (C) further comprises:

(Cl) selecting said reflective and transmission means from the group consisting of: {an optical cavity; and a Fabry-Perot cavity}.

15. (Original) The method of claim 13, wherein said step (C) further comprises:

(C2) accumulating said generated photons in said magnon gain medium by using said reflective and transmission means attached to said surface area of magnon gain medium.

16. (Original) The method of claim 15, wherein said step (C2) further comprises:

(C2, 1) accumulating a threshold number of said generated photons in said magnon gain medium, wherein said threshold number of accumulated photons is substantially sufficient for nonlinear photon-photon interaction process.

17. (Original) The method of claim 16, wherein said step (C2, 1) further comprises:

(C2, 1, 1) changing the frequency of said generated photons by using said nonlinear photon-photon interaction process.

18. (Original) The method of claim 1 further comprising:

(D) utilizing a waveguide attached to said magnon gain medium to output said generated photons outside said magnon gain medium.

19. (Original) The method of claim 18, wherein said step (D) further comprises:

(Dl) accumulating said generated photons in an outside optical cavity attached to said waveguide,

20. (Original) The method of claim 18, wherein said step (D) further comprises:

(D2) accumulating a threshold number of said generated photons in said outside optical cavity attached to said waveguide, wherein said threshold number of accumulated photons is substantially sufficient for nonlinear photon-photon interaction process.

21. (Original) The method of claim 20, wherein said step (D2) further comprises:

(D2, 1) changing the frequency of said generated photons by using said nonlinear photon-photon interaction process.

22. (Withdrawn) An apparatus for photon generation comprising:

(A) a magnon gain medium; wherein said magnon gain medium supports generation of nonequilibrium magnons;

and

(B) a means for generating said nonequilibrium magnons in said magnon gain medium; wherein interaction between said nonequilibrium magnons causes generation of photons.

23. (Withdrawn) The apparatus of claim 22 further comprising:

(C) a thermostat, wherein said magnon gain medium is placed in said thermostat, and wherein said thermostat is configured to maintain temperature of said magnon gain medium below a critical temperature.

24. (Withdrawn) The apparatus of claim 22, wherein said means (B) further comprises:

(Bl) a means for injecting nonequilibrium electrons into said magnon gain medium; wherein propagation of said nonequilibriura electrons in said magnon gain medium causes generation of said nonequilibrium magnons; and wherein interaction between said nonequilibrium magnons causes generation of photons.

25. (Withdrawn) The apparatus of claim 24, wherein said means (Bl) further comprises:

(Bl, 1) a means for pumping nonequilibrium electrons into said magnon gain medium.

26. (Withdrawn) The apparatus of claim 24, wherein said means (Bl) further comprises:

(Bl, 2) a means for pumping nonequilibrium polarized electrons into said magnon gain medium.

27. (Withdrawn) The apparatus of claim 22 further comprising:

(D) a reflective and transmission means attached to surface area of said magnon gain medium, wherein said reflective and transmission means are configured to manipulate said reflection coefficient of said generated photons at said surface area of said magnon gain medium, and wherein said reflective and transmission means are selected from the group consisting of: {said optical cavity; and said Fabry-Perot cavity}.

28. (Withdrawn) The apparatus of claim 22 further comprising:

(E) a waveguide attached to said magnon gain medium, said waveguide configured to output said generated photons outside said magnon gain medium.

29. (Withdrawn) The apparatus of claim 22 further comprising:

(F) an outside optical cavity attached to said waveguide, wherein said outside optical cavity is configured to accumulate said generated photons.

30. (Previously Added) The method of claim 1, wherein said step (A) further comprises:

(A3) providing said magnon gain medium; wherein said magnon gain medium includes a conduction (valence band) that splits into two subbands, and wherein said first subband is configured to be populated by electrons having spin up, and wherein said orientation of spin up is an orientation directed along a direction of a magnetization of said magnon gain medium; and wherein said second subband is configured to be populated by electrons having spin down, and wherein said orientation of spin down is an orientation directed opposite to said direction of said magnetization of said magnon gain medium.

31. (Previously Added) The method of claim 1, wherein said step (A) further comprises:

(A4) providing said raagnon gain medium; wherein said magnon gain medium includes said conduction (valence band) that splits into said two subbands, and wherein said first subband is configured to be populated by electrons having spin up; and wherein said second subband is configured to be populated by electrons having spin down; and wherein said two snbbands with said spin up and said spin down are separated by an exchange gap.

32. (Previously Added) The method of claim 1, wherein said step (A) further comprises:

(A5) providing said magnon gain medium; wherein said magnon gain medium includes said conduction (valence band) that splits into said two subbands, and wherein said first subband is configured to be populated by electrons having spin up; and wherein said second subband is configured to be populated by electrons having spin down; and wherein said two subbands with said spin up and said spin down are separated by said exchange gap; and wherein if an exchange energy is positive then a bottom of said subband with said spin up is located below a bottom of said subband with said spin down.

33. (Currently Amended) The method of claim 1, wherein said step (A) further comprises:

(A6) providing said magnon gain medium; wherein said magnon gain medium includes said conduction (valence band) that splits into said two subbands, and wherein said first subband is configured to be populated by electrons having spin up; and wherein said second subband is configured to be populated by electrons having spin down; and wherein said two subbands with said spin up and said spin down are separated by said exchange gap; and wherein if said exchange energy is positive then said bottom of said subband with said spin up is located below said bottom of said subband with said spin down; and if said gap Δ is much larger than the maximum of {T, Ef}, wherein T is temperature of said magnon gain medium, and wherein Ef is a Fermi energy of electrons, then only the electron states in said lower subband with spin up are occupied in equilibrium, i.e. the electrons are **fully** polarized.

34. (Previously Added) The method of claim 1, wherein said step (A) further comprises:

(A7) providing said magnon gain medium; wherein said magnon gain medium includes said conduction (valence band) that splits into said two subbands, and wherein said first subband is configured to be populated by electrons having spin up; and wherein said second subband is configured to be populated by electrons having spin down; and wherein said two subbands with said spin up and said spin down are separated by said exchange gap; and wherein if said exchange energy is negative then said bottom of said subband with said spin up is located above said bottom of said subband with said spin down.

STATEMENT UNDER ARTICLE 19 (1).

The amended and added claims do not add any new matter neither to the description no to the drawings.