

35

90. The method described in claim 74 wherein the representation comprises a representation of a source of a first magnetic field occurring within the sample volume displayed in two of three orthogonal Cartesian coordinates referenced to the sample volume.

91. The method described in claim 74 wherein the representation comprises a representation of a source of a first magnetic field occurring within the sample volume displayed in three of three orthogonal Cartesian coordinates referenced to the sample volume.

92. The method described in claim 74 wherein the radiation detecting means comprises a plurality of photodetectors, wherein each photodetector provides a signal comprising characteristics related to the low intensity magnetic field.

93. A high sensitivity diagnostic imaging atomic magnetometer comprising

- a) a sensing cell sensitive to low intensity magnetic fields, the sensing cell comprising an alkali metal vapor and a buffer gas, the sensing cell being adjacent to a sample volume for containing at least a portion of a subject that generates a first magnetic field, wherein the sensing cell is exposed to
 - i) the first magnetic field; and
 - ii) a background magnetic field;
- b) a first radiation generating means that generates a first beam of radiation illuminating the alkali metal vapor, the first beam being effective to increase the magnetic polarization of the alkali metal vapor, wherein the magnetic polarization of the alkali metal vapor includes a contribution from the first magnetic field;
- c) magnetizing means for imposing a second magnetic field on a volume of space comprising the sensing cell;
- e) one or more second radiation generating means that generates one or more second beams of radiation traversing the alkali metal vapor for probing the magnetic polarization of the alkali metal vapor, the one or more second radiation beams providing one or more second output beams of radiation after they traverse the vapor, the second output beams comprising characteristics related to the first magnetic field;
- f) a plurality of output detecting means that detect the second output beams and provide a plurality of signals comprising characteristics related to the first magnetic field;
- g) a computational module comprising a plurality of signal processing means for
 - i) receiving the plurality of signals;
 - ii) differentially comparing a first signal and a second signal in a way that is effective to minimize a

36

background magnetic field component in the signals thereby providing resultant output signals;

iii) determining the characteristics of the first magnetic field present in the resultant output signals;

iv) and providing a representation of the first magnetic field; wherein the representation is useful in diagnostic imaging of the subject.

94. A method of conducting diagnostic imaging on a subject comprising the steps of

- a) placing at least a portion of the subject that generates a first magnetic field in a sample volume adjacent to a sensing cell sensitive to low intensity magnetic fields, the sensing cell comprising an alkali metal vapor and a buffer gas, wherein the sensing cell is exposed to
 - i) the first magnetic field; and
 - ii) a background magnetic field;
 - b) increasing the magnetic polarization of the alkali metal vapor by illuminating the alkali metal vapor with a first beam of radiation, wherein the magnetic polarization of the alkali metal vapor includes a contribution from the first magnetic field;
 - c) reorienting the magnetic polarization of the alkali metal vapor by imposing a second magnetic field on a volume of space comprising the sensing cell;
 - e) probing the magnetic polarization of the alkali metal vapor with one or more second beams of radiation that traverse the alkali metal vapor, the one or more second radiation beams providing one or more second output beams of radiation after they traverse the vapor, the second output beams comprising characteristics related to the first magnetic field;
 - f) detecting the second output beams with a plurality of output detecting means that provide a plurality of signals comprising characteristics related to the first magnetic field;
 - g) receiving the plurality of signals in a computational module comprising a plurality of signal processing means that
 - i) differentially compares a first signal and a second signal in a way that is effective to minimize a background magnetic field component and provides resultant output signals;
 - ii) determines the characteristics of the first magnetic field present in the resultant output signals; and
 - iii) provides a representation of the first magnetic field;
- wherein the representation is useful in diagnostic imaging of the subject.

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