H.W. II

Josh Lucas

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1 SPINS LAB 1

$|\langle out||in\rangle|^2$	$|+\rangle$	$|-\rangle$	$|+\rangle_x$	$|-\rangle_x$	$|+\rangle_y$	$|-\rangle_y$
$\langle +|$	1	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
$\langle -|$	0	1	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
$_x\langle +|$	$\frac{1}{2}$	$\frac{1}{2}$	1	0	$\frac{1}{2}$	$\frac{1}{2}$
$_x\langle -|$	$\frac{1}{2}$	$\frac{1}{2}$	0	1	$\frac{1}{2}$	$\frac{1}{2}$
$_y\langle +|$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
$_y\langle -|$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	0	1

2 CH.1 DEFINITIONS

Orbital Angular Momentum L • The electron, from a classical viewpoint has angular momentum around a radius. $L = mvr$ This momentum of a charged particle creates current loops which induce a magnetic moment.

Intrinsic Angular Momentum, S, Spin • Similar to a satellite in orbit rotating as it revolves an

electron classically has a rotation called spin. The spin also produces current loops.

Gyroscopic Ratio • A dimensionless scalar constant that relates spin of a particle with the magnetic moment μ as in $\vec{\mu} = g\frac{q}{2m}\vec{S}$.

Quantization • The act of organizing information in to discrete sets.

Spin $\frac{1}{2}$ system • The Stern-Gerlach observations showed that spins of the particles were orientated in either a up or down configuration, $\vec{S}_z = \pm\frac{\hbar}{2}$

Observable • The physical quantity that is measured.

Analyzer • A device which can distinguish the spin configuration of particles.

Ket • Symbolic representation of the quantum state.

Bra •
Symbolic representation of the complex conjugate of quantum state.
State Preparation Device • When a device such as Stern-Gerlach device separates the up and down spins of particles they are said to be prepared in that state.

Local Hidden Variable Theory • The theory that there could be another yet undiscovered fact or trait about the system that would account for the observations.

Incompatible Observables • Observables that cannot be know simultaneously as in knowing orthogonal spin components of a particle.

Quantum State Vectors • The mathematicle representation of the quantum state of a system containing both the real and complex information.

Hilbert Space • Vector space defined for a system that limits space to the necessary dimensions.

Dot Product •

S_z **basis** • The possible contents of the set.

Orthonormality •
The combination of normalizing and making orthogonal a vector or state.
Normalization Constant • The complex constant C

Probability •

Probability Amplitude •

Superposition State • The combination of states containing both up and down spins

Mixed State •

Coherent Superposition •

Column-Row Vectors •

Representation • Collection of coefficents that multipy the basis set

Kronecker Delta • Binary logical operator, True if equal, false if not.