Re: "quantum mechanics and experience"−−non separability

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richardconers@yahoo.com:
>I'm reading "Quantum mechanics and experience". It's starting to sink
>in, and I hope I can use this formum to clarify some points as I go
>along (I finished reading it, but I'm reading it a second time because
>there's no way I get it entirely in the first round <g>.)
>
>My big hang−up so far is understanding non−locality/non−separability
>of 2 particle states. Albert doesn't explain how such a state comes
>about in the first place.

OK, that's fairly straight forward to answer. If two particles are produced by independent processes, the particles will be independent. For example, the usual atomic transition results produces a single photon and the orbital angular momentum of the atom changes by 1 because the photon carries it off. When several atoms radiate, you get several photons, but since all of the transitions are independent, the photons emitted are independent. Now consider a transition in which two photons are produced by a single decay. This will happen in a so−called forbidden transition, in which the angular momentum doesn't change, e.g., a transition from an S state to another S state. In that case, the photons cannot carry off any angular momentum, so you must get a pair of photons with a total spin of zero, i.e., the state is non−separable because the process that produced it was really a single transition. The most famous example is laser light.

>Can I assume that all combinations of 2 particles at a time are
>NOT in a non−separable state?

No, and in fact you might be better assuming the opposite. Any bound system like an atom, is really a single quantum state. That is why one has to write the hyperfine states in hydrogen as an F = 0, singlet and an F = 1, triplet, and not try to talk about the electron spin and proton spin separately. You can talk about the spins separately if you introduce a magnetic field to uncouple them, which is one of the ingredients in magnetic resonance imaging.

>Also, I don't understand why Albert makes such a big deal out of
>non−locality. If two particles are in a "non−separable state" where
>the color of A is opposite the color of B (A+B = 0) is the quantum
>state of the two particle system, then non−locality seems to follow
>logically.

That's a rather subtle issue that involves what you mean by ``locality". In the days of classical physics, everyone was pretty much of the opinion you just described, but there's more to it than that, because non−locality implies some superluminal connection between two measurements in the sense that one measurement is the cause for the outcome of the second. If that were true, you could use that to send messages faster than light. But quantum mechanics doesn't let you do that and in general you still cannot assign a time ordering to the two spacelike measurements. As far as quantum mechanics is concerned, the two measurements happen at the same time, which is fine with relativity, because two spacelike separated observers are free to define a coordinate system in which the measurements happen simultaneously.