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On spin in spin networks

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It is reasonable to think that the spin labels of spin networks have nothing to do with physical rotation or spin. However, intriguingly, in situations involving rotating black holes, a connection between the spin of spin networks and angular momentum has been established. Here I want to consider this connection from another angle: Can we talk about the spin of fermions in loop quantum gravity? I will briefly review kinematical quantum states involving fermions. I will then report on work together with R. Mansuroglu and J. Große: We propose observables involving fermion spins, such as scalar products of spins or the total spin of a number of fermions. They involve parallel transport of spins with the Ashtekar-Barbero connection. I will then describe some of their properties and spectra. In particular there are plenty of gauge invariant states with nonzero total fermion spin, which demonstrates that the "gauge spin" of the spin networks and the fermion spin are distinct, although closely related, concepts.I will also comment on correlation between fermion spin and area, as it appears that aligning spins increases area. The effect seems much too small however, to be observable. Altogether, the results seem to show that in the presence of fermions, some of the spin in spin networks is actual physical spin. They also raise the question in how far this might even be true in the absence of fermions.

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