A genuine tripartite entanglement of a Heisenberg mixed spin-(1/2,1,1) trimer in a magnetic field

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A genuine tripartite entanglement is rigorously analyzed in a quantum mixed spin-(1/2,1,1) Heisenberg trimer with a geometric structure of an elementary triangular plaquette in presence of an external magnetic field. Two different strengths of the Heisenberg interaction J_1 (for identical spins) and J (for various spins) are taken into account. A genuine tripartite entanglement is quantified according to the negativity, utilizing the one of the generally accepted definition in which, the tripartite entanglement is a geometric mean of three various negativities between a single spin and a couple of remaining two spins. It turns out that the model under the investigation is always *fully inseparable* (entangled) if $J_1/J \leq 1$ until the increasing magnetic field favors the fully polarized separable state. In contrast, the tripartite entanglement cannot emerge for $J_1/J > 1$ due to a full separability of the spin-1/2 entity from the spin-1 dimer. Moreover, it was demonstrated that the tripartite thermal entanglement can be detected also at non-zero temperatures, even in a $J_1/J > 1$ limit, where the tripartite quantum entanglement is not possible. Unexpectedly, the maximum of negativity magnitude is detected at relatively high magnetic field as a consequence of competition between thermal fluctuations and exchange interactions.

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