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Foundational aspects of Supersymmetry via the Dressing Field Method

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I will explore some foundational aspects of supersymmetric field theories under the perspective of the Dressing Field Method (DFM), a new systematic tool to exhibit the gauge-invariant content of general-relativistic gauge field theories.

First, I will show that the gauge-fixing conditions typically used to extract the degrees of freedom of the Rarita-Schwinger spinor-vector and gravitino fields are actually instances of the DFM. Since the latter has a natural relational interpretation, solving the dressing functional constraints actually realises the Rarita-Schwinger spinor-vector and gravitino fields as *relational variables*.

I will then discuss the *unconventional supersymmetry* proposal by Alvarez, Valenzuela, and Zanelli, aiming to use the framework of supersymmetric field theory to describe fermionic matter fields and bosonic gauge fields as parts of a single superconnection, showing that the so-called *matter ansatz* underlying the theory is a special case of the DFM.

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