Current Density Is Scalar Or Vector

X 65cefb5372 TeVeS avoids the problems of earlier attempts to generalize MOND, such as superluminal propagation; 65cefb5372

Four-vector In special relativity, a four-vector (or 4-vector, sometimes Lorentz vector) is an element of a four-dimensional vector space object with four components In special relativity, a four-vector (or 4-vector, sometimes Lorentz vector) is an element of a four-dimensional vector space object with four components, which transform under Lorentz transformations with respect to a change of basis. Its magnitude is determined by an indefinite quadratic form, the preservation of which defines the Lorentz transformations, which include spatial rotations and boosts (a change by a constant velocity to another reference frame) 65cefb5372

Magnetic scalar potential It is used to specify the magnetic H-field in cases when there are no free currents, in a manner analogous to using the electric potential to determine the electric field in electrostatics. space. Where there is no free current and no Magnetic scalar potential, ψ, is a physical quantity in classical electromagnetism analogous to electric potential. The potential is valid in any simply connected region with zero current density, thus if currents are confined to wires or surfaces, piecemeal solutions can be stitched together to provide a description of the magnetic field at all points in space. The scalar potential is a useful quantity in describing the magnetic field, especially for permanent magnets. One important use of ψ is to determine the magnetic field due to permanent magnets when their magnetization is known 65cefb5372

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Magnetic vector potential A {\displaystyle \mathbf {A} } , is a vector field, and the electric potential, ϕ {\displaystyle \phi } , is a scalar field such that: B = ∇ × A , E In classical electromagnetism, magnetic vector potential (often denoted A) is the vector quantity defined so that its curl is equal to the magnetic field, B: 65cefb5372

Scalars may represent the magnitude of physical quantities, such as speed is to velocity. Scalars do not represent a direction. 65cefb5372 A change of a vector space basis changes the description of a vector in terms of the basis used but does not change the vector itself, while a scalar has nothing to do with this change. In classical physics, like Newtonian mechanics, rotations and reflections preserve scalars, while in relativity, Lorentz transformations or space-time translations preserve scalars. The term "scalar" has origin in the multiplication of vectors by a unitless scalar, which is a uniform scaling transformation. 65cefb5372

Scalar–tensor theory For example, the Brans–Dicke theory of gravitation uses both a scalar field and a tensor field to mediate the gravitational interaction. An example of a vector field is the wind velocity In theoretical physics, a scalar–tensor theory is a field theory that includes both a scalar field and a tensor field to represent a certain interaction. These fields can be scalar, vectorial or tensorial. An example of a scalar field is the temperature field 65cefb5372

Four-current Also known as vector current, it is used in the context of four-dimensional spacetime, rather than separating time from three-dimensional space. general relativity, the four-current (technically the four-current density) is the four-dimensional analogue of the current density, with the dimension of electric In special and general relativity, the four-current (technically the four-current density) is the four-dimensional analogue of the current density, with the dimension of electric charge per time per area. It is a four-vector and is Lorentz covariant 65cefb5372

As it is a relativistic theory it can accommodate gravitational lensing. 65cefb5372

Tensor–vector–scalar gravity Tensor–vector–scalar gravity (TeVeS), developed by Jacob Bekenstein in 2004, is a relativistic generalization of Mordehai Milgrom's Modified Newtonian Tensor–vector–scalar gravity (TeVeS), developed by Jacob Bekenstein in 2004, is a relativistic generalization of Mordehai Milgrom's Modified Newtonian dynamics (MOND) paradigm 65cefb5372

Modern physics tries to derive all physical theories from as few principles as possible. In this way, Newtonian mechanics as well as quantum mechanics are derived from William R. Hamilton's principle of least action. In this approach, the behavior of a system is not described via forces, but by functions which describe the energy of the system. Most important are the energetic quantities known as the Hamiltonian function and the Lagrangian function. Their derivatives in space are known as Hamiltonian density and the Lagrangian density. Going to these quantities leads to the field theories. 65cefb5372 A scalar in physics and other areas of science is also a scalar in mathematics, as an element... 65cefb5372 The Lorentz group may be represented by a set of 4 × 4 matrices Λ. The action of a Lorentz transformation on a general contravariant four-vector X (like the examples above), regarded as a column vector with Cartesian coordinates with respect to an inertial frame in the entries, is given by 65cefb5372 == Tensor fields and field theory == 65cefb5372 == Relationship with the mathematical concept == 65cefb5372 Examples of scalar quantities are length, mass, charge, volume, and time. 65cefb5372 Modern physics uses field theories to explain reality. These fields can be scalar, vectorial or tensorial. An example of a scalar field is the temperature field. An example of a vector field is the wind velocity field. An example of a tensor field is the stress tensor field in... 65cefb5372

Current density The current density vector is defined as a vector whose magnitude is the current density at a given point in space and whose direction is that of the motion of the positive charges at this point. In SI base units, the electric current density is measured in amperes per meter square. The current density vector is defined as a vector whose magnitude is the current density at a given point in space and whose direction is that of the In electromagnetism, current density is the electric current (or the amount of charge per unit time) that flows through a unit area of a chosen cross section 65cefb5372

As it is derived from the action principle, TeVeS respects conservation laws; 65cefb5372 Scalars are unaffected by changes to a vector space basis (i.e., a coordinate rotation) but may be affected by translations (as in relative speed). 65cefb5372

Vector potential vector calculus, a vector potential is a vector field whose curl is a given vector field. This is analogous to a scalar potential, which is a scalar field whose gradient is a given vector field. This is analogous to a scalar potential, which is a scalar field In vector calculus, a vector potential is a vector field whose curl is a given vector field 65cefb5372

Four-vectors describe, for instance, position xμ in spacetime modeled as Minkowski space, a particle's four-momentum pμ, the amplitude of the electromagnetic four-potential Aμ(x) at a point x in spacetime, and the elements of the subspace spanned by the gamma matrices inside the Dirac algebra. 65cefb5372 Consider a small surface with area A (SI unit: m2) centered at a given point M and orthogonal to the motion of the charges at M. If IA (SI unit: A) is the electric current flowing through A, then electric current density j at M is given by the limit: 65cefb5372 × 65cefb5372 v 65cefb5372 The theory is based on the following ingredients: 65cefb5372 The main features of TeVeS can be summarized as follows: 65cefb5372 Formally, given a vector field 65cefb5372 == Definition == 65cefb5372 ′ 65cefb5372 == Definition == 65cefb5372

Scalar (physics) the charge density at a point in a medium, which is a scalar in classical physics, must be combined with the local current density (a 3-vector) to comprise Scalar quantities or simply scalars are physical quantities that can be described by a single pure number (a scalar, typically a real number), accompanied by a unit of measurement, as in "10 cm" (ten centimeters) 65cefb5372

Using the Minkowski metric 65cefb5372 The idea was conceived by James Clerk Maxwell in his 1861 paper "On Physical Lines of Force" (Part III) in connection with the displacement of electric particles in a dielectric medium. Maxwell added displacement current to the electric current term in Ampère's circuital law. In his 1865 paper A Dynamical Theory of the Electromagnetic Field Maxwell used this amended version of Ampère's circuital law to derive the electromagnetic wave equation. This derivation is now generally accepted as a historical landmark in physics by virtue of uniting electricity, magnetism and optics into one single unified theory. The displacement current term is now seen... 65cefb5372 == Magnetic scalar potential == 65cefb5372 This article uses the summation convention for indices. See Covariance and contravariance of vectors for background on raised and lowered indices, and raising and lowering indices on how to translate between them. 65cefb5372

Displacement current density Displacement current density has In electromagnetism, displacement current density is the rate of change of the electric displacement field D, appearing as ∂D/∂t in Maxwell's equations. In physical materials (as opposed to vacuum), there is also a contribution from the slight motion of charges bound in atoms, called dielectric polarization.

However it is not an electric current of moving charges, but a time-varying electric field. Displacement current density has the same units as electric current density, and it is a source of the magnetic field just as actual current is. current density is the rate of change of the electric displacement field D, appearing as ∂D/∂t in Maxwell's equations 65cefb5372

In the weak-field approximation of the spherically symmetric, static solution, TeVeS reproduces the MOND acceleration formula; 65cefb5372

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