

## Vague ideas

Monday 27 March 2023 17:15 (35 minutes)

One sense in which a physical claim may qualify as a “principle”, as opposed to a law for example, is that it expresses a typically general-sounding but *vague* idea. The talk will deliver a case study for this notion. While there is a longstanding discussion about the interpretation of the extended, general principle of relativity, there seems to be a consensus that the *special* principle of relativity is an absolutely clear statement. However, a closer look at the literature on relativistic physics reveals a more confusing picture. The talk will illustrate this situation by discussing how Einstein uses the special relativity principle in his 1905 paper. It will be pointed out that Einstein applies three different versions of the principle—three different statements with different physical content. The first version is the relativity principle as applied in the magnet-conductor thought experiment, by which Einstein famously begins, and motivates, his analysis. The second version is the requirement of covariance that Einstein uses in deriving the transformation laws of the electric and magnetic field strengths in the electrodynamical part of his article. The third variant is the way in which Einstein applies the relativity principle when deriving the equation of motion for the moving point charge in the closing section of the 1905 paper. It will be shown how each of the three versions is problematic and often vague in its own terms, and how they are manifestly nonequivalent, two of them being even contradictory together. Along the way, our analysis will lead us to pose several obvious, but not obviously answerable, questions about the precise meaning of the principle of relativity. To turn the statement of the relativity principle from a vague idea into an unambiguous physical claim, each of these questions requires a sharp answer.

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