

# On Relativistic Mass

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As the present status of relativistic mass in spacetime physics cannot be regarded as satisfactory, I will argue that it should not be silently tolerated. To describe the controversy over the status of relativistic mass, Max Jammer devoted a whole chapter (Chapter 2) of his excellent book *Concepts of Mass in Contemporary Physics and Philosophy* [1] – he pointed out that during the last three decades physicists have witnessed (rather endured) “what has probably been the most vigorous campaign ever waged against the concept of relativistic mass” (for some additional details, see the Appendix (by the editor) “On Relativistic Mass” in a new publication of five works by Einstein [2]).

The present status of relativistic mass in spacetime physics is indeed worrying. On the one hand, the physics community is divided – some firmly reject the concept of relativistic mass (e.g., in papers entitled “The Virus of Relativistic Mass in the Year of Physics” [3]), whereas others continue to regard it as an integral part of spacetime physics including in books published last year (see, for example [4,5]).

On the other hand, both mass and relativistic mass appear to be *equally* supported by the experimental evidence – since *mass is defined as the measure of the resistance a particle offers to its acceleration* (which is the accepted definition based on the experimental evidence) and since it is also an *experimental fact that a particle’s resistance to its acceleration increases* indefinitely (in a given reference frame) as the particles velocity approaches the speed of light (in the same reference frame), it follows that the particle’s mass increases when its velocity increases. Therefore the concept of relativistic mass (like the concept of mass) reflects an experimental fact.

My talk will be divided into two main parts. First, I will explain why I believe the relativistic increase of mass is an experimental fact. Second, I will address the relevant arguments raised against the concept of relativistic mass.

## References

1. M. Jammer, *Concepts of Mass in Contemporary Physics and Philosophy* (Princeton University Press, Princeton 2000) p. 51.
2. A. Einstein, *Relativity*, edited by V. Petkov (Minkowski Institute Press, Montreal 2018)
3. L. B. Okun, “The Virus of Relativistic Mass in the Year of Physics,” in: *Gribov Memorial Volume: Quarks, Hadrons, and Strong Interactions*, Proceedings of the Memorial Workshop Devoted to the 75th Birthday of V. N. Gribov, (World Scientific Publishing, Singapore 2009), pp. 470-473.
4. A. Romano, M. M. Furnari, *The Physical and Mathematical Foundations of the Theory of Relativity: A Critical Analysis*, (Birkhäuser, Springer Nature Switzerland AG 2019)
5. H. Günther, V. Müller, *The Special Theory of Relativity: Einstein’s World in New Axiomatics* (Springer 2019). See particularly p. 91: “The velocity independence of masses is incompatible with the Lorentz-transformation.”