# On the Interpretation of the Equation $E = mc^2$: Response to Krajewski

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Władysław Krajewski and I would have agreed on many things concerning Einstein's equation, $E = mc^2$. Beyond the agreements that he lists (Krajewski 2006), I agree that in the case of photon emission, there is no conversion of mass into energy. I can agree to this because the core of the *different-properties, conversion* view is that while special relativity allows for genuine conversions of mass and energy, many purported conversions are best understood exactly as Bondi and Spurgin (1987) suggest, and Krajewski advocates. The *different-properties, conversion* view, which I defend, is not the view that *all* purported conversions of mass and energy are genuine conversions. It is instead the view that according to special relativity, all by itself and without an attendant theory of matter, genuine conversions are *possible* (cf. Flores 2005, p. 248). Genuine conversions would occur specifically in cases where, for example, the reactants in an annihilation reaction are treated as idealized point-particles, which I unfortunately called "philosophical atoms" (Flores 2005, p. 249). Thus, the *different-properties, conversion* view is motivated by relativistic point-particle mechanics, where one assumes that point-particles are a suitable idealization of some forms of matter. The view of Bondi and Spurgin, by contrast, seems to depend on treating all particles as wholes with parts, though Krajewski's examples seem to suggest otherwise.

Krajewski's reply has inspired me to revisit the connection between theories of matter and mass–energy equivalence. On the one hand, I was perhaps a bit hasty in rejecting the philosophical viability of Bondi and Spurgin's interpretation on the basis of its commitment to a theory of matter outside special relativity. On the other hand, perhaps I unwittingly overemphasized the point-particle idealization where genuine conversions are not forbidden by special relativity. Given that the world is not likely to contain point-particles, if an interpretation is supposed to tell us what the world is like

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according to special relativity, then I believe that the *different-properties, no-conversion* interpretation favoured by Krajewski is a good interpretation of all the empirical results that confirm Einstein's equation, $E = mc^2$.

I regret not having been able to discuss these matters with Professor Krajewski before his death, and sincerely hope that he would have enjoyed this exchange.

## References

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