Albert Einstein to George Ellery Hale [1] FREE

Albert Einstein

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bet she can't fly a helicopter!"

May we all excise inconsiderate talk from our physics vocabulary.

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Until I read Matt Landreman's Opinion piece, I thought the affliction he described was specific to computer scientists. When asked to explain any particular topic, a computer scientist invariably begins with "Basically, . . ." and then fills several chalkboards with detailed set-theory equations. It's good to know that physicists are also on the cutting edge when it comes to belittling the masses!

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Having taught physics at Swarthmore College from 1955 to 1958, I suspect I know something of Matt Landreman's experience there. I had some very good students, but unfortunately for them and me, I don't believe any of them made it to Oxford University on a Rhodes scholarship. To the litany of trivial stories I can add mine from when I took Philip Morse's Methods of Theoretical Physics course at MIT. When Morse explained how he got the answer to some problem, I complained, "That was a trick!" He replied, "A trick that works twice is a method."

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I agree with the spirit of Matt Landreman's Opinion but not with all of its substance. Words such as "trivial" and "easy" are sometimes used in a patronizing manner, but I think they are more often intended in the spirit of a hint. If an author tells me that a derivation is "easy," I take it to mean that if I get bogged down in some messy equations I am probably doing it wrong and should back up and try again. That hint can save me from flailing away needlessly on the wrong path. I would urge that such adjectives be used with discretion and care rather than eliminated altogether.

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Landreman replies: The use of "easy" and its synonyms described by Rio Beckwith is indeed a standard one. We utter these words to convey that a calculation is not analytically impossible, that it does not require the years of monastic toil required to prove the Last Theorem of Fermat, or that the solution is immediately comprehended by the speaker—who, unlike his audience, has regularly thought about the topic for the past 10 years. But the English language provides other words that more aptly express what we mean: "possible," "feasible," "soluble," "practicable." There is nothing inherently wrong with an instructor's hinting that a student's derivation involving 17-term expressions and elliptic integrals is probably going awry. However, you can be a much more effective communicator

Albert Einstein to George Ellery Hale[1]

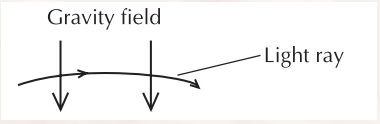
Translated and annotated by Bertram Schwarzschild

Einstein writes to Hale (1868–1938), director of the Mount Wilson Observatory near Los Angeles, seeking advice about the observability of the gravitational bending of light he had recently deduced from the equivalence principle.[2] Einstein's 1913 prediction is only half the deflection predicted by the full general theory of relativity, completed two years later.

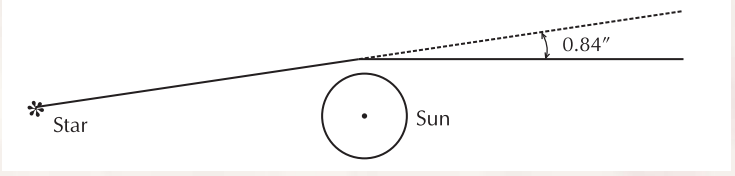
Zurich, 14 October 1913

Highly honored colleague,

A simple theoretical consideration makes it plausible to assume that light rays in a gravitational field experience bending.



At the edge of the Sun, the total deviation should be 0.84 arcseconds, and it should fall off like 1/*R* (*R* being the ray's [closest] distance from the Sun's center).



It would therefore be of the greatest interest to know how close to the Sun fixed stars could be seen *in daylight* with the strongest magnification.

On the advice of my colleague, Professor [Julius] Maurer, I therefore ask you to let me know what you—with your rich experience in these things—take to be achievable with the best modern instruments.

Yours very respectfully,

A. Einstein

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Hale responded that "there is no possibility of detecting the effect in full sunlight." But he did pronounce the alternative of exploiting a solar eclipse "very promising."[3]

The rest of the story has become Einstein lore: A German team set out to measure the effect in Russia during an upcoming 1914 eclipse. But the outbreak of war intervened. In a sense, that was fortunate, because the team would have been comparing the measurement with Einstein's first, incorrect *prediction. By the time Arthur Eddington's eclipse expedition set out in 1919, the predicted effect had doubled and the war was over. Eddington's confirmation of the general-relativistic bending of light, albeit with a large observational uncertainty, made Einstein instantaneously famous.*

References

1. *The Collected Papers of Albert Einstein*, vol. 5, M. J. Klein, A. J. Fox, R. Schulmann, eds., Princeton U. Press, Princeton, NJ (1993), p. 559.
2. A. Einstein, proceedings of *Schweizerische Naturforschende Gesellschaft* **96**, part 2, 137 (1913), in *The Collected Papers of Albert Einstein*, vol. 4, M. J. Klein, A. J. Fox, J. Renn, R. Schulmann, eds., Princeton U. Press, Princeton, NJ (1995), p. 475.
3. *The Collected Papers of Albert Einstein*, vol. 5, M. J. Klein, A. J. Fox, R. Schulmann, eds., Princeton U. Press, Princeton, NJ (1993), p. 566.