

T3_80 PROJECTILE SOLUTIONS ON MINKOWSKI DIAGRAM

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Physics is difficult, theory of relativity is very far even from the university students. Therefore it is very important to motivate students to understand the basic ideas of theoretical physics for example the principles of theory of relativity. In this paper, a problem (and its solution) connected to the popular novel "Lord of Rings" is presented which leads toward some question of special relativity. Generalizing the problem it is also shown, that one dimensional problems of the theory of special relativity can be solved by geometrical constructions using the concept of Minkowski space-time. The construction of a Minkowski space time diagram highly supports the understanding of the principal ideas of the theory of special relativity. It gives the possibility of visualization and qualitative demonstration of the ideas which are so strange for the gumption. Numerical solution of the problems on the Minkowski diagram is not easy due to the distortion of the measure originating from the hyperbolic geometry of the space-time. The scaling of the coordinate axis of the moving system is determined by a hyperbola, therefore it is difficult to read the numerical value of the lengths and times involved into the problems. It will be shown, that through the comparison of the invariant scalars of the Euclidean geometry and those of the Minkowski geometry a scaling factor can be derived which gives exactly the distortion of the measures, so the solution of the problems can be carried out with the help of a ruler. Having the scaling factor it is possible to solve exactly all the one dimensional problems (length contraction, time dilatation, relativistic velocity addition and arbitrary dynamical question) belonging to the frame of the special relativity by the use exceptionally geometrical constructions on the Minkowski diagram without the application of any further algebraic equation. Practically speaking the method presented in the paper encodes the Lorentz transformation into the structure of the Minkowski diagram and therefore the diagram involves all the consequences of the Lorentz transformation.