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The Ancient Brachistochrone in Today's "Star-Trek" World

TERRY PALMER, Retired — More than 300 years ago, Johann Bernoulli published one of the great puzzles in mathematics. In "Acta Eruditorum" he issued the challenge, "Given two points A and B in a vertical plane, what is the curve traced out by a point acted on only by gravity which starts at A and reaches B in the shortest time?" He called this curve, the "Brachistochrone," and his solution was founded on "Fermat's Principle" and a uniform gravitational force. Bernoulli's puzzle, now known as the Brachistochrone Problem, stimulated a new field of mathematics called, "The Calculus of Variations." Mathematicians and physicists still solve generalizations of the Brachistochrone Problem using the Calculus of Variations. This paper applies the disciplines of Classical Mechanics and the Calculus of Variations to find Brachistochrones for particles traveling in four speed regimes: Ordinary speeds, Relativistic speeds, Super-Luminal speeds (like a Tachyon traveling faster than light speed) and Ultra-Luminal speeds (Tachyons traveling at nearly infinite speeds). The author finds the Brachistochrones in these speed regimes for two separate forces: the uniform gravitational force (the same force assumed by Bernoulli) and the inverse-square force.

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