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Introduction to paths H and application of homotopy theory in physics FIDELE TWAGIRAYEZU, Texas State University — Firstly, we introduced the action of space operators on a regular interval to generate a variable interval. Secondly, we introduced the concept of a family T of paths H, and we showed that these paths are homotopic on a contractible space even though they do not have common endpoints. Finally, we applied the concept of paths H on a contractible space in physics. Let A be a subset of X. Let $I_{\{a,b\}}$ be a regular interval such that $\{I_{\{a,b\}}\} \subseteq$ A, for a, b $\in$ A. Let (α_a, β_b) be space operators associated with{a,b}, then a variable interval is $I_{\{x,y\}} = (\alpha_a, \beta_b) I_{\{a,b\}}$ such that $\{I_{\{x,y\}}\} \subseteq$ X, min$\{I_{\{x,y\}}\}$=ax, and max$\{I_{\{x,y\}}\}$=by for all x, y $\in$X. Let X be a topological space. Let f, g: [0,1] $\rightarrow$X be continuous paths for all t $\in$ [0,1]. T is the family of continuous paths H: [0,1]x[0,1]$\rightarrow$ X such that H(t,0)=f, H(t,1)=g for all t $\in$ [0,1], and H(0,s_f) =f(0), H(1,s_f) =f(1), H(0, s_g) =g(0), H(1,s_g) =g(1) for all $s_{f,}$ s_g $\in$ [0,1]. Such f and g are H-topic paths. If X is contractible, then H is a homotopy. In addition, if s_f =s_g, then f(0)=g(0) and f(1)=g(1), and the family T of paths H becomes the well-known homotopy of paths (with same endpoints). Let M_G be a simply connected gravitational field. We showed that the Hamiltonian for free fall-paths on M_G obeys the homotopy theory.

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