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# HIGH ENERGY PHYSICS COLLOQUIA

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## QUANTUM CLOCK: A CRITICAL DISCUSSION ON SPACE-TIME

### Abstract

We critically discuss the measure of very short time intervals. By means of a Gedankenexperiment, we describe an ideal clock based on the occurrence of completely random events. We show that the minimum time interval  $\Delta t$  that this clock can measure scales as the inverse of its size  $\Delta r$ . This implies an uncertainty relation between space and time:  $\Delta r \Delta t > G\hbar/c^4$  where  $G$ ,  $\hbar$ , and  $c$  are the gravitational constant, the Planck constant, and the speed of light, respectively. We outline and briefly discuss the implications of this uncertainty principle.

In the second part of this seminar, we will discuss an experiment, that could be mounted on a space station or borne on a balloon, consisting in a very large area detector, capable to investigate (sub)millisecond structures in the prompt emission of Gamma Ray Bursts. We show that energy-dependent time lags in these phenomena could probe the granular structure of the space-time fabric down to the Planck scale.

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