

Quantum Entanglement and the Flow of Time Animations

“Now” List

By Mark Egdall 6/15/ 09
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Based on Brian Greene's *The Fabric of the Cosmos*

1. Animation on Now List:

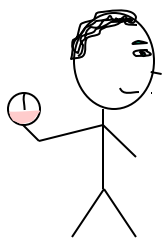
- What you perceive as *now* really depends on the speed of light
 - Because it takes *time* for the light from an event to reach your eyes.
 - You must take this into account to determine what happens “now”.



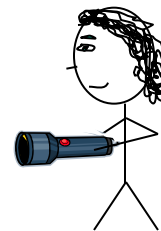
How to Determine a Now-List

Bill has stopwatch

Sandy has laser flashlight



Bill



Sandy

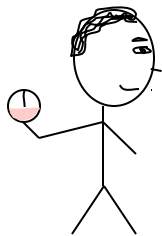


How to Determine a Now-List

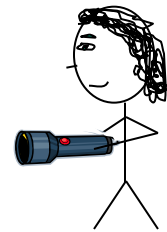
Bill has stopwatch

Sandy has laser flashlight

- Bill measures *distance* to Sandy



Bill



Sandy

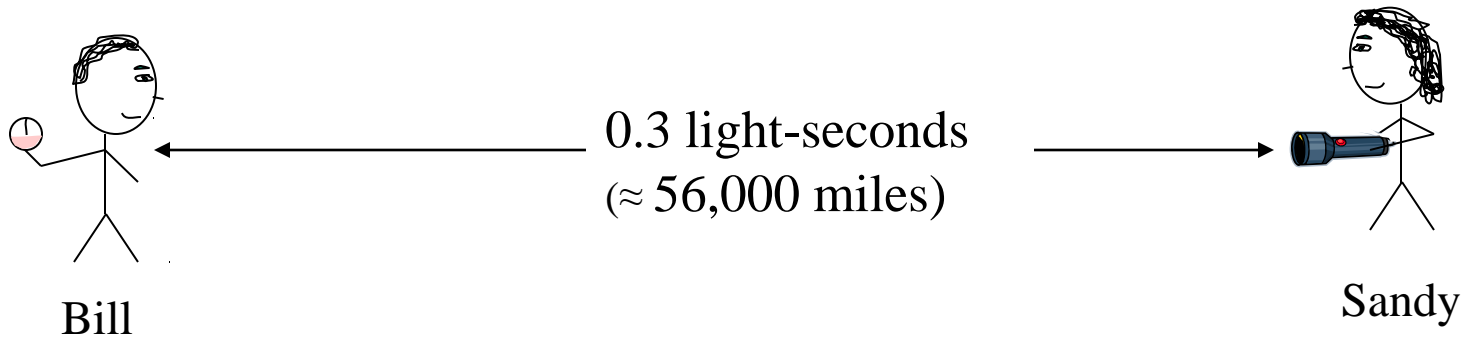


How to Determine a Now-List

Bill has stopwatch

Sandy has laser flashlight

- Bill measures *distance* to Sandy



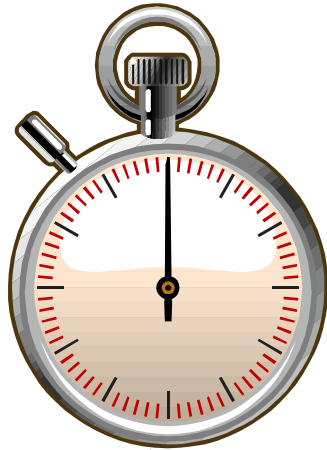
not to scale



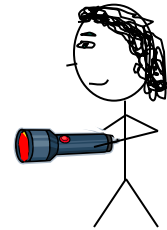
How to Determine a Now-List

Bill sets his stopwatch to 0.0 seconds

At 0.0 seconds:



Bill



Sandy

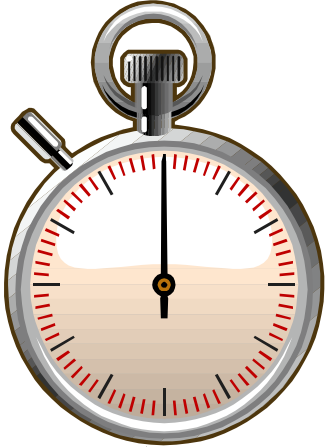


How to Determine a Now-List

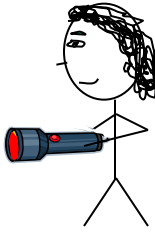
Bill sets his stopwatch to 0.0 seconds

At 0.0 seconds:

Imagine he happens to say “NOW” and start his stopwatch at the exact *same time* that Sandy fires her laser



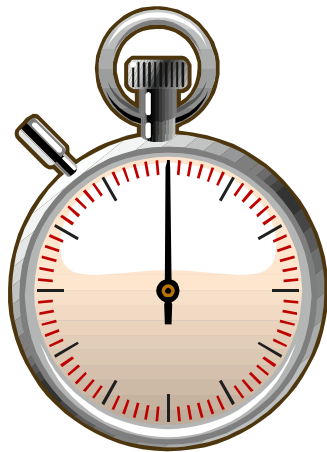
Bill



Sandy



How to Determine a Now-List



Bill sets his stopwatch to 0.0 seconds

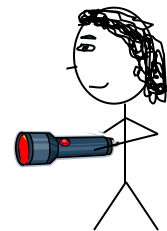
At 0.0 seconds:

Imagine he happens to say “NOW” and start his stopwatch at the exact *same time* that Sandy fires her laser



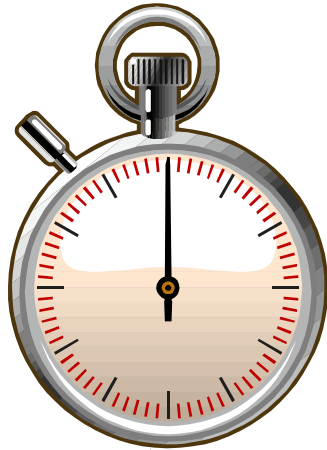
Bill

But how does he *know* he said “now” at the same time as Sandy fired her laser?



Sandy

How to Determine a Now-List



At 0.0 seconds:



Bill
starts stopwatch



Sandy
turns on laser
flashlight *at*
same time



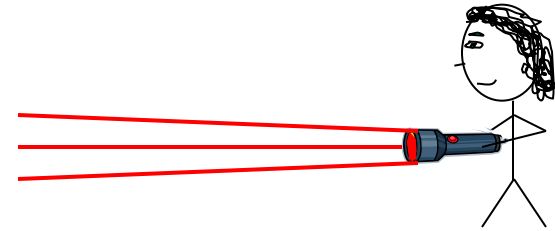
How to Determine a Now-List



0.1 seconds



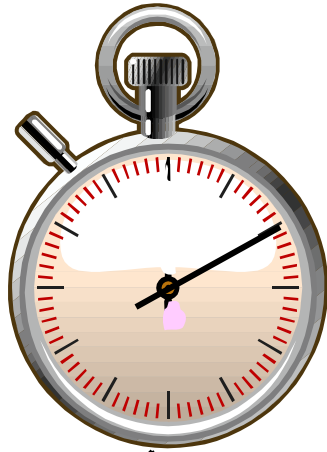
Bill



Sandy



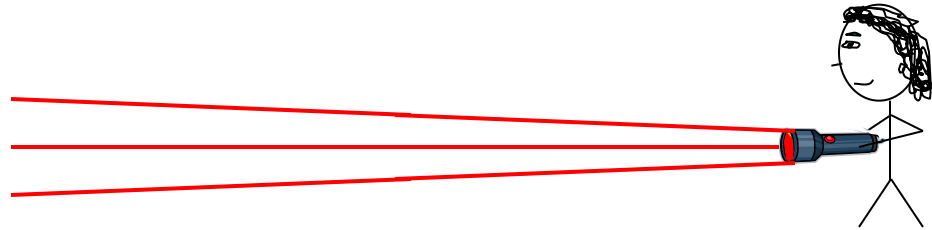
How to Determine a Now-List



0.2 seconds

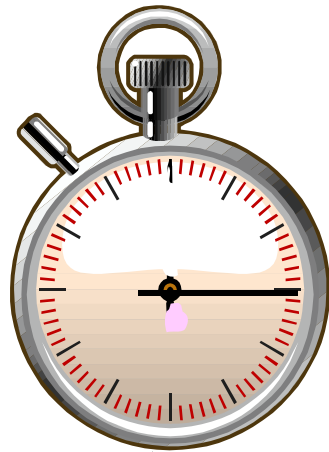


Bill

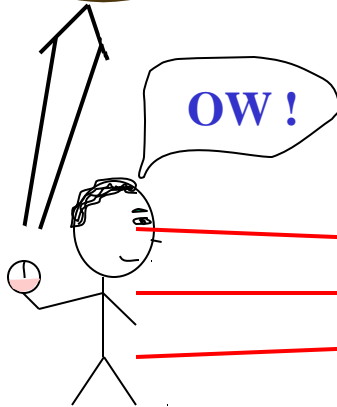


Sandy

How to Determine a Now-List



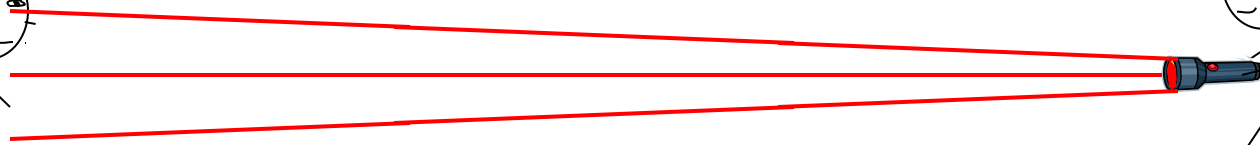
0.3 seconds



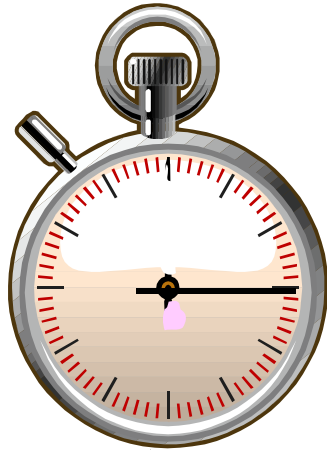
Bill



Sandy

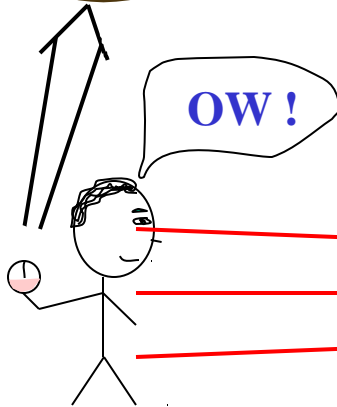


How to Determine a Now-List



0.3 seconds

Bill receives light from Sandy **0.3 seconds** after he started stop watch



Bill



Sandy

- Bill determined that Sandy is a distance of 0.3 light-seconds away from him.
- His stopwatch tells him it took 0.3 seconds from the time he said “now” to when the light from Sandy’s laser reached him

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From this distance measurement and stopwatch time, Bill concludes:

→ **Sandy turned on flashlight *at the same time* as he said “Now”**