

THE KOBAYASHI MARU IN THE DELTA QUADRANT REVISITED

Before beginning the latest adventures of Captain Janeway and Security Chief Tuvok in their diplomatic mission to the strife torn world of Sciion Encefict II, a slight recap is necessary. Here is the recap of the story, so far. They were trying to mediate a dispute between two rival factions on the planet. Their efforts failed. They were drugged and awoke to find themselves on a sub-light speed spacecraft. They were totally unfamiliar with the region of space they were in. Tuvok determined that the deflector shields were down, and because of that they were in danger of being hit by a micro-meteor. He also discovered that a nano-fusion device was deftly wired into the circuits of the deflector shields and would be triggered, if they were turned on.

Janeway wanted to turn on the deflector shields. She hoped the damage from the explosion would be minimal. They could then try to repair the damaged circuit. Tuvok suggested they determine the velocity at which the spacecraft was traveling before making a decision. If the spacecraft was moving at a very slow velocity, there was a greatly reduced chance of being hit by a micro-meteor, and they could proceed at a more leisurely pace in their efforts to determine how the nano-fusion device could be bypassed.

Tuvok reconfigured their communication devices and phasers

into an apparatus to measure the velocity of the spacecraft. It consisted of two synchronized clocks that could be stopped and started by a beam of light and a device that produced a beam of light. They would position the synchronized clocks 10 feet apart. They assumed that if the spacecraft was moving, it was moving forward, and they could tell from the design of the spacecraft which way that was. They positioned the light source so that it was behind both of the synchronized clocks. When the light beam passed by the clock, the clock would shut itself off.

The speed of light is one foot per nanosecond. If they were at rest the clock positioned farthest from the light source would stop itself 10 nanoseconds after the clock closest to the light source stopped itself. If they were traveling at .5 the speed of light, the clock positioned farthest from the light source would stop itself 20 nanoseconds after the clock closest to the light source stopped itself. If they were traveling at .75 the speed of light, the clock positioned farthest from the light source would stop itself 40 nanoseconds after the clock closest to the light source stopped itself and so on.

As they were about to perform the experiment, the dusky Vulcan stated, "According to the theories of Einstein, our clocks are not synchronized."

Janeway looked at him quizzically and replied, "But, we positioned the clock's light sensors as close together as possible

when we directed the light beam on the sensors to start the clocks. And, previously we had set both clocks to zero.”

Tuvok continued, “But, since we moved the clock , which is now positioned the farthest away, ten feet from where it was when it was synchronized with the other clock; it is now considered a distant clock according to Einstein. And, there is by definition only one method by which distant clocks may be synchronized.”

“This is getting as headache inducing as time travel paradoxes. Let’s just synchronize the distant clocks and perform the experiment,” Janeway retorted.

“That presents a problem. If we synchronize the distant clocks according to Einstein’s method, we will not be able to ascertain by analyzing the clock’s temporal coordinates the nature of this spacecraft’s motion.”

“If the distant clocks are synchronized, the experiment will work and we will be able to calculate the velocity of this spacecraft,” an incredulous Janeway insisted.

“It’s not that simple. Einstein’s method for synchronizing distant clocks introduces factors that make it impossible to determine the absolute motion of an object, only the relative motion.”

“How can a method of synchronizing clocks do that?” Janeway asked with growing impatience.

“According to Einstein this is the way we must synchronize our

two clocks. An observer must be stationed at the midpoint between the two clocks. He must have a device that allows him to decide if incoming light beams arrive at the same time. For long distances it could be mirrors arranged in a precise way. For short distances such as ours it would need to be a sophisticated photoelectric device that could detect the slightest differences in the arrival time of incoming light beams.”

Janeway interrupted Tuvok, saying, “I don’t see any problem with that; get to the point, if you have one.”

Unperturbed the Vulcan continued, “Each of our clocks must be equipped with a beam of light that is connected to the clock so that as soon as the beam of light is turned on the clock is turned on. The beams of light must then be directed at the photoelectric device located at the midpoint. If the photoelectric device determines that the beams arrived at the same time the distant clocks are synchronized. If the photoelectric device determines the light beams didn’t arrive at the same time, the clocks are reset to zero and the procedure is repeated. By using trial and error plus intuition the clock/light beam operators can synchronize their distant clocks.”

“Wait a minute,” Janeway commanded, “The light beams travel 5 feet, correct. If the spacecraft is traveling at .5 the speed of light, the midpoint will be rushing to the beam of light from the farthest clock at .5 the speed of light. So it will only take the light beam 3+

nanoseconds to reach the midpoint.”

“Precisely 3 and $\frac{1}{3}$ nanoseconds,” the Vulcan interjected.

“3 and $\frac{1}{3}$, 3 and $\frac{1}{3}$, 3 and $\frac{1}{3}$!” Janeway shouted angered by the Vulcan’s penchant for inordinate precision. “But,” Janeway continued with an irritated tone, “the midpoint will be rushing away from the beam of light coming from the nearest clock at .5 the speed of light. So it will take the beam of light from the nearest clock 10 nanoseconds to reach the midpoint.”

“Affirmative,” was Tuvok’s only response, wishing to avoid another emotional outburst.

“This is worse than a time travel paradox. When the distant clocks are synchronized according to Einstein, the farthest clock will be running 7 nanoseconds slow compared to the nearest clock.”

“Six and $\frac{2}{3}$ nanoseconds....”