What a bike moving at near the speed of light might look like to a human observer

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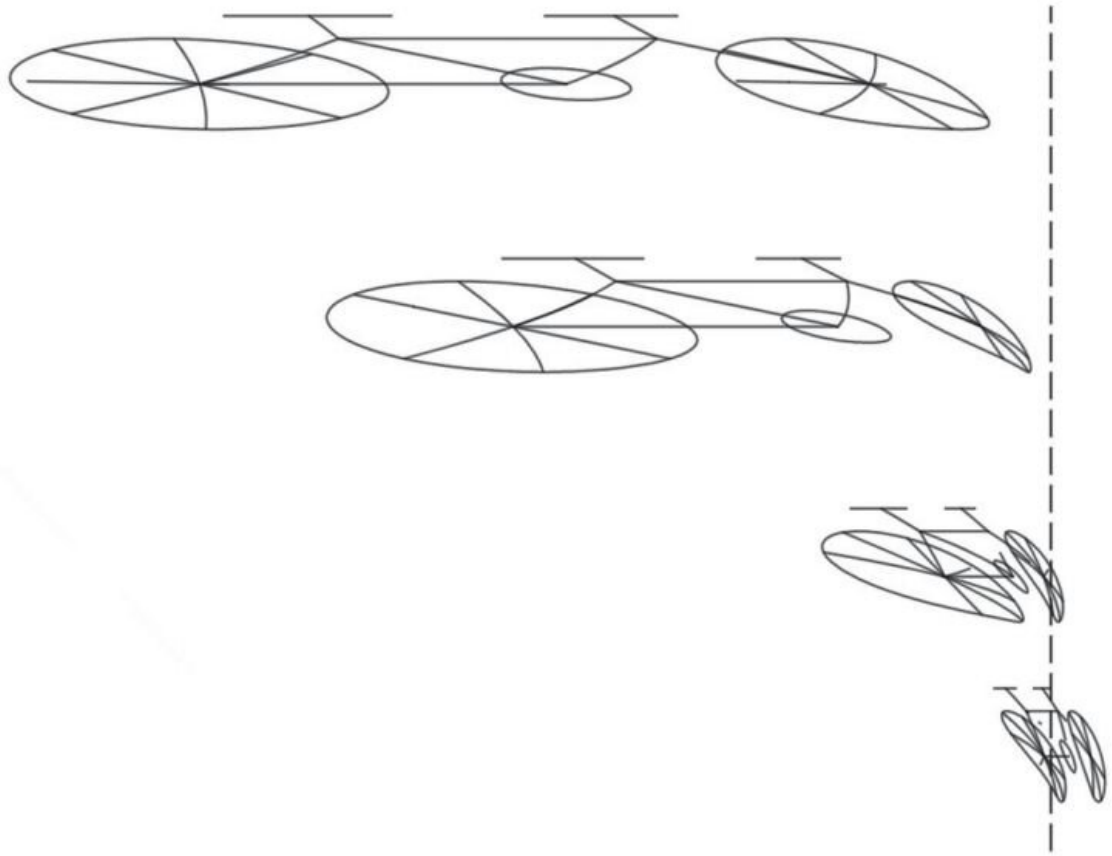

Figure illustrating deformation of a 2-D bicycle with β = 0.9 with the dashed line representing the cross section of the y–z plane. Credit: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* (2020). DOI: 10.1098/rspa.2019.0703

A pair of researchers at Surrey University has attempted to show what a bicycle moving at near the speed of light might look like to a human observer. In their paper published in the journal *Proceedings of the Royal Society A*, E. C. Cryer-Jenkins, and P. D. Stevenson expand on prior research that attempted to describe how a near-light-speed object would appear to a camera, this time focusing on its appearance to a binocular observer.

Not long after Einstein published his ideas on special relativity, others began to wonder what an object moving near the speed of light would look like—in the 1930s, physicist George Gamow proposed a thought experiment on the subject in a physics book for children. He suggested the bike would appear to be Lorentz contracted. That view held until the 1950s, when Roger Penrose and James Terrell pointed out problems with that concept—images on camera film are generated by photons arriving at the same moment, for example, not by those emitted by the object at the same time. Thus, what a person sees is a patchwork of photons knitted together coming from the object at different times. Terrell suggested that such an object would look as if rotated with its rear portion proportionally increasing in relation to its face.

Later work suggested the images of such an object captured by a camera would be even more complex due to a number of distortions. Notably, most such work focused on what an object might look like if photographed at near light speed. In this new effort, the researchers have expanded on prior research to allow for the introduction of a binocular observer—a person with two eyes. If a bicycle is moving past someone, left to right, images of it are formed in the left eye before the right—at normal speeds, the brain is able to make up for this lag, giving humans a seamless movie-like impression of objects in the world around them.

To account for the time lag, the researchers added an analytical time delay—applying it to the transformations of the object's true location

relative to its apparent location. They also factored in the Doppler effect and intensity shifts that would be involved with such an object. They then produced a simulation showing what they believe a bicycle would look like to a human as it moved at near the speed of light.

More information: E. A. Cryer-Jenkins et al. Gamow's cyclist: a new look at relativistic measurements for a binocular observer, *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* (2020). DOI: 10.1098/rspa.2019.0703