

Astronomy Talk 11th June 2022

Relativity

Danny Thomas from the Farnham AS gave this talk in the lecture hall, with remote Zoom attendees making it a hybrid event. 24 attended on Zoom and 15 in the hall.

Danny was at pains to make this extremely well-prepared talk on a difficult subject approachable for all. He remarked that the main reason it's difficult is that it's beyond our everyday experience.

Firstly, he talked about why relativity's so important to astronomers, including extremely fast and very massive objects, e.g., black holes. He discussed a lot of the history behind it, including Maxwell's equations and the Michelson-Morley experiment, both of which showed the speed of light to be invariant in all frames of reference.

This, and other precursors led Einstein to his special theory of relativity in 1905. If not him, someone else would have undoubtedly produced it at about the same time. General relativity's (1915) basic premise is that there's no difference between acceleration and gravity, from which all else follows. That theory too had precursors, e.g., it was anticipated by Minkowski in 1908, so we can say both were theories whose time was ripe.

The clocks in GPS system satellites run slower because of their velocity (special relativity) by 7.2 microseconds/day, and they run faster by 45.9 microseconds/day because they're further from the Earth's gravity (general relativity). Both these must be taken into account to get the accuracy we need.

Danny talked about curvature of space, e.g., the precession of Mercury's orbit and the putative planet "Vulcan" that supposedly caused it until general relativity explained it.

After giving us many examples that worked very well in clarifying the subject, Danny finished by remarking on a couple of things we don't understand. One is quantum entanglement; the other is the unification of relativity and quantum mechanics, both of which work extremely well and yet are incompatible.

Many questions followed, inevitably mostly about black holes.