Source No 2

Newton's law of gravitation registered its greatest triumph in 1846. The sun orbit of the planet Uranus which was discovered in 1781 showed slight shifts. Observations over half a century confirmed this situation clearly. Astronomers arrived at the conclusion that Uranus was affected by the gravity impact of a hitherto undiscovered planet located beyond Uranus. The English astronomer John Couch Adams and French astronomer Urbain Jean Joseph Leverrier calculated the position of that hypothesized planet based on Newton's theories. In 1846 the German astronomer Johann Gottfried Galle set his telescope to the point determined earlier by Leverrier and found a new planet a exactly the predicted position. Since then this planet exists under the name "Neptune".

From this date on, it was believed that no other view would shatter Newton's law of gravitation. But now, the motion of one the planets remained without explanation. The point that the planet Mercury reaches at its closest approach the sun (perihelion), showed a shift from one orbiting cycle to another. Not twice did the planet appear in its "annual" sun orbits at the same position. The astronomers attributed this irregularity in large part to the gravity force of the neighboring planets having a "disturbing" impact on Mercury's orbit,

Indeed, the scientific thinking as displayed in the works of the early period of gravitational theory is characterized by the view that the turbulences that were to appear in the course of changes in the effects of the gravitational force exerted bye one planet on another planet could, on a given day, disturb the delicate balance of the solar system. Also, at the beginning of the nineteenth century the French astronomer Pierre Simon Laplace demonstrated that the solar system is not quite such a "capricious" system. All disruptive turbulences formed in a given period, the irregularities occurred in a certain direction and in a certain number, with no exceeding of this number being observed. For a long time the solar system remained stable and the astronomers were convinced that if only some disturbing turbulences were properly taken into account, no problem of special irregularities would occur otherwise.

However, the planet Mercury shook this belief. Despite benign consideration of all causes there was a yet unexplained one-directional change in the orbit of Mercury at its closest point of approach to the sun and this change measured in a hundred years 43 arc seconds. In addition to this unexpected movement predicted by Leverrier in 1845 still another phenomenon was not accounted for. In 4,000 years, the arc width value was only that of the moon. Well, this was sufficient to trouble the astronomers.

Leverrier took the view that this path deviation could be caused by a planet closer to the sun than Mercury is. For years, astronomers tried to locate that hypothetical planet (which in advance they baptized "Vulcan") and not a few reports of its discovery were published. However, all news proved false. Finally, it was definitely decided that Vulcan does not exist.

Just then Einstein's general theory of relativity proved the expected answer. It said that the perihelion (point closest to the sun) of each body located in an orbit must have a movement different from that predicted by Newton's law. New calculations proved the suitability of the theory of general relativity when applied to deal with the perihelion advance of the planet mercury. Also the orbits of other planets at a greater distance from the Sun than Mars should show small perihelion advances. In 1960 it was found that in a hundred years the perihelion of Venus's orbit showed a difference of 8 arc seconds. This perihelion advance fits exactly Einstein's theory.

"White dwarfs" (stars) with high density. Observing the spectral lines of white dwarfs, they found them shifted just as they had expected.

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