The Point of Origin of A/2017 U1

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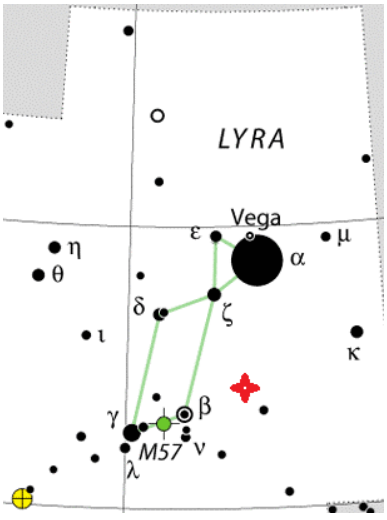
The confirmation that A/2017 U1 which, if it is of the low albedo that its reddish colour indicates, has a diameter of 200-250 metres, has interstellar origin, has created great interest in the astronomical community. There is already speculation about its possible point of origin, although it seems that we can rule out as a candidate Vega.

The latest JPL solution to the orbit of A/2017 U1 is JPL#9, calculated on November 1st based on 96 observations over 16 days. The solution has been extremely stable since the original announcement by Gareth Williams on MPEC 2017-U181 that the then C/2017 U1 (Pan-STARRS) appeared to show a strongly hyperbolic orbit and interstellar nature. The latest eccentricity figure is e=1.197, slightly higher than originally calculated, indicating that the object entered the solar system with a velocity of 26km/s, equivalent to 1 light year every 11000 years. In contrast, the typical velocity at infinity of a comet in an open orbit after escape from the solar system will be only a few tens or hundreds of metres per second. This means that, if A/2017 U1 has escaped from another solar system, it was expelled with an exceptionally high energy orbit.

The latest orbit solution gives a point of origin of the comet close to coordinates R.A. 18h 40m 39s, Dec. +34°08′26″. This is a point in Lyra (see the map, left). The nearest bright star to this point is the magnitude 6.5, B5V star HD173087 at more than 1000 light years distance, which is around 43 arcminutes southeast and thus an unlikely candidate to be the source of A/2017 U1. Although Vega is currently ≈3°.5 north of the point of origin of A/2017 U1, its proper motion is from the southwest – 201mas East, 286mas North – and, ≈25000 years ago would have been much closer to the point of origin. At the same time, Vega is approaching at 13km/s, so any object expelled from a hypothetical Vegan Oort Cloud would have at least this entry velocity in our solar system.



However, 26km/s equates to 1 light year every 11000 years, more than half a million years journey time from the current distance of Vega and requiring expulsion from the Vegan system more than a million years in the past, when Vega would have been a considerable distance away from the point of origin. In other words, although Vega passed close to the trajectory of A/2017 U1, it was hundreds of thousands of years later and so Vega could not have been the point of origin. The best guess is A/2017 U1 is a genuine interstellar wanderer that has spent tens, hundreds, perhaps thousands of millions of years in transit from an indeterminate original source.