SHAPE AND SIZE OF (90) ANTIOPE DERIVED FROM AN EXCEPTIONAL STELLAR OCCULTATION ON JULY 19 2011. F. Colas[1], J. Berthier[1], F. Vachier[1], S. Degenhardt[2], D. Dunham[2,3], J. Garlitz[2], T. George[2,8], P. Maley[2], S. Preston[2], B. Timerson[2], R. Venable[2], M. Allain[4], K. Burns[5], R. Cawthon[4], J.R. Cooper[4], J.E. Enriquez[4], J. Fixelle[4], S. Hicks[4], P. Jenniskens[4], F. Marchis[1,4], W.L. Meldman-Floch[4], W.J. Merline[6], J. Minteer[4], W. Owen[7], M. Philipps[4]. [1]Observatoire de Paris, IMCCE, Paris, France, (colas@imcce.fr), [2] International Occultation Timing Association, Montgomery, AL, USA, [3] KinetX, Inc., Tempe, AZ, USA, [4] SETI Institute, Mountain View, CA, USA, [5] Dept Astronomy, UC Berkeley, Berkeley, CA, USA, [6] Southwest Research Institute, Boulder, CO, [7] Jet Propulsion Laboratory, Pasadena, CA, USA, [8] Columbia Basin College, Pasco, WA, USA.

Introduction: On July 19 2011 UT, double asteroid (90) Antiope occulted the magnitude 6.7 HIP 112420 (LQ Aqr) star, with a path predicted over much of northern California. This is by far the best observed stellar occultation by a double asteroid. One of the major result of this event is the confirmation of the crater like feature on the southern component suggested by Descamps et al. [1]. Combined with light curve data, it is now possible to better constrain the 3D model of the system, which can be fitted to the sharp silhouette derived from the occultation, an then measure the volume and the density with a better accuracy.

Occultation data: Through a large international collaboration driven by IOTA (International Occultation and Timing Association) and IMCCE, we organized a successful campaign of observations. A total of 42 observers and 92 stations spread along the occultation path in northern California, Nevada, Idaho and Oregon allowed us to fully sample both components (Fig 1). The stellar occultation was positively recorded by 43 stations with a maximum duration of ~33 s. Most of the observers used video camera with time inserter controlled by GPS, which allowed a timing accuracy of 50ms, equivalent to 0,6 km at the asteroid level.

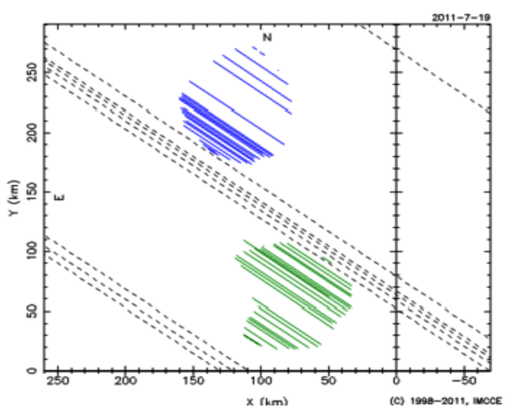

Fig 1 – Whole set of observed occultation chords , an irregularity is clearly visible on the southern part.

Reduction: LQ Aquarii is a "slow red" (LB) variable star, with B-V ~ 1.66. As the diameter of this super giant star is unknown, the main issue of the reduction is to take into account the non negligible time needed to occult the star. A preliminary work gives an estimation of the star's diameter of 1.7 ± 0.7 mas [2], which is equivalent to 2.2 ± 0,9 km at the asteroid level. Compared to the accuracy of 0.6 km expected from the timings, it is actually important to improve the accuracy on the star diameter.

Analyze: We fitted a Roche ellipsoid (Fig 2) , the results is a separation of 180km compared to 171km previously determined by Descamps et al.[2]. The equivalent resulting radius are 47.7km and 45.6km..

Results: With the light curve data giving the orbital period, we recompute the total mass from the third Kepler's law and the density from the new volume. In the framework of our methodology, based on the Roche equilibrium figures, as the size of the orbit has been slightly increased, the sizes of the two components increased as well, consequently the bulk density remains unchanged with a value around 1,28 g/cm^3.

Another important result is the confirmation of the presence of a huge feature on the southern component which was suggested by Descamps et al.[2].The position is now found at long 315° and lat -40°, which is on the opposite side of the previous model. This large structure can be explain by a huge impact, but how this component could have survive to this kind of impact?

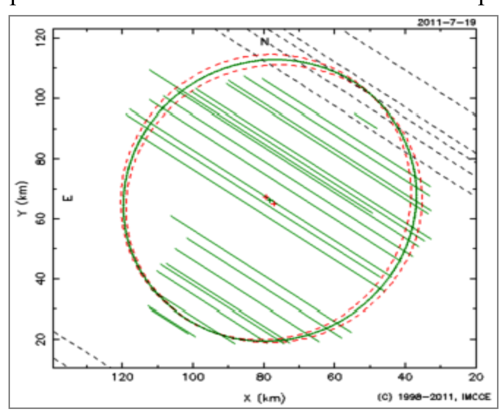

Fig 2: Chords of the southern component enlightening the "big crater" or excavation [2].

Conclusion: This occultation was important to confirm the low bulk density of 1,28 g/cm^3 implying an high porosity as noted by Marchis [3] and show the utility to organize campaign for such events..

References: [1] Descamps P. et al (2009) *Icarus 203*, 102[2] George T., IOTA (2011) *Private communication,* [3] Marchis F. et al (2011) *Icarus, 213,* 264.