HAVE STELLAR OCCULTATIONS PROBED CHARON'S CHASMATA? A. M. Zangari[1], K. N. Singer[1], R. A. Beyer[2], P. M. Schenk[3], J. M. Moore[2], W. B. McKinnon[4], S. A. Stern[1], L. A. Young[1], H. A. Weaver[5], C. B. Olkin[1], K. Ennico[2], and the New Horizons Geology, Geophysics, and Imaging Team, [1]Southwest Research Institute 1050 Walnut Street, Suite 300 Boulder, CO 80302 (azangari@boulder.swri.edu), [2]NASA Ames Research Center, Moffett Field, CA 94035. [3]Lunar and Planetary Inst., 3600 Bay Area Blvd., Houston, TX 77058, [4]Dept. Earth and Planetary Sciences, Washington University, St. Louis, MO 63130, [5] Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723

Introduction: In 2005, an occultation by Charon was observed by three different occultation groups [1,2,3]. The eight combined observations give a radius of 606 ± 1.5 km [4], which shows fantastic agreement with the New Horizons result of 606 km ± 3 km [5]. When compiling the 2005 occultation chords, Person et al. (2006) noted a discrepancy between the results from the Southern Astrophysical Research ("SOAR") telescope and Gemini South observations taken at Cerro Pachón, versus the six other occultation chords. While both chords have consistent, too-short duration, the start and stop times of the chords do not not match the the fit required for a spherical body or each other [4].

New Horizons has revealed Charon's surface for the first time, showing a moon with craters, chasmata, mons, and maculae. The chasmata and craters on Charon have sufficient depth to reduce the length of an occultation chord, and features on the limb show clear relief. The full frame images of Charon on the day of closest approach have sufficient resolution to diagnose whether occultation light curves could have interacted with large surface features, and work on a digital elevation model has begun. We look to see if the a shorter-than-expected occultation chord seen by Person et al. is the result of a crater or other deep topographic feature, checking other published Charon chords at the same time.

Occultations Examined: In addition to the 2005 occultation, we examine single chord events from 1980 (SAAO) [6], 2008 (Les Makes) [7], and 2011 (IRTF) [8]. The events from the latter two light curves included a Pluto occultation that allowed conclusive identification of the side of Charon's shadow the occultation chord fell upon. The 1980 event at SAAO is a single light curve and it is unknown whether the north or south side of Charon's shadow was observed. Thus the extrema of the the occultation chord was calculated.

Table 1 lists each observation site and the longitude and latitude of the ingress points, while Table 2 lists the egress points. Each location was calculated using the New Horizons radius of 606 km. Latitude is defined such that the north/positive pole points in the direction of Charon's angular momentum vector, and longitude increases to the east, with a zero point at the sub-Pluto longitude (these longitudes are 180º offset from Pluto longitudes). All longitude are in degrees.

Results: Figure 1 shows a the location of each occultation overlaid on a map of Charon's surface. The colored portion of the map represent areas where digital elevation models are available, while blacked out areas were in shadow for New Horizons' visit. The SOAR/Gemini South occultation chords correspond to sites 11 (ingress) and 12 (egress). While site 12 falls upon a hidden winter region, site 11 has DEM information available. A deep crater neighbors site 11, but it is not close enough. It begins about 30 km to the west with its deepest point along this limb line is roughly 60 kilometers away. Thus, an unseen feature is likely responsible for the discrepancy. No other occultation point with DEM information falls near a distinctive topographic feature.

References:

[1] Young, L. A., et al. 2005, IAU Circ., 8570, 2. [2] Gulbis, A. A. S., et al. 2006, Nature, 439, 48. [3] Sicardy, B., et al. 2006, Nature, 439, 52. [4] Person, M. J., et al. 2006, AJ, 132, 1575. [5] Stern, S. A., et al. 2015, Science, 350. [6] Walker, A. R. 1980, MNRAS, 192, 47P. [7] Sicardy, B., et al. 2011, AJ, 141, 67. [8] Person, M. J., et al. 2013, AJ, 146, 83.

Table 1: Ingress Locations

Charon Ingress Locations

Site Name	Ingress ID	Ingress Longitude	Ingress Latitude
SAAO-	1	-118.	68.
SAAO+	3	-149.	38.
San Pedro	5	-4.	-3.
Cerro Armazones, Paranal	7	-24.	23.
du Pont, Clay	9	-76.	53.
Gemini South, SOAR	11	-97.	55.
El Leoncito	13	-127.	50.
Les Makes	15	-29.	45.
IRTF	17	156.	44.

Table 2: Egress Locations

Charon Egress Locations

Site Name	Egress ID	Egress Longitude	Egress Latitude
SAAO-	2	31.	-38.
SAAO+	4	62.	-68.
San Pedro	6	7.	-18.
Cerro Armazones, Paranal	8	33.	-42.
du Pont, Clay	10	107.	-52.
Gemini South, SOAR	12	124.	-47.
El Leoncito	14	144.	-35.
Les Makes	16	-112.	-22.
IRTF	18	40.	-25.

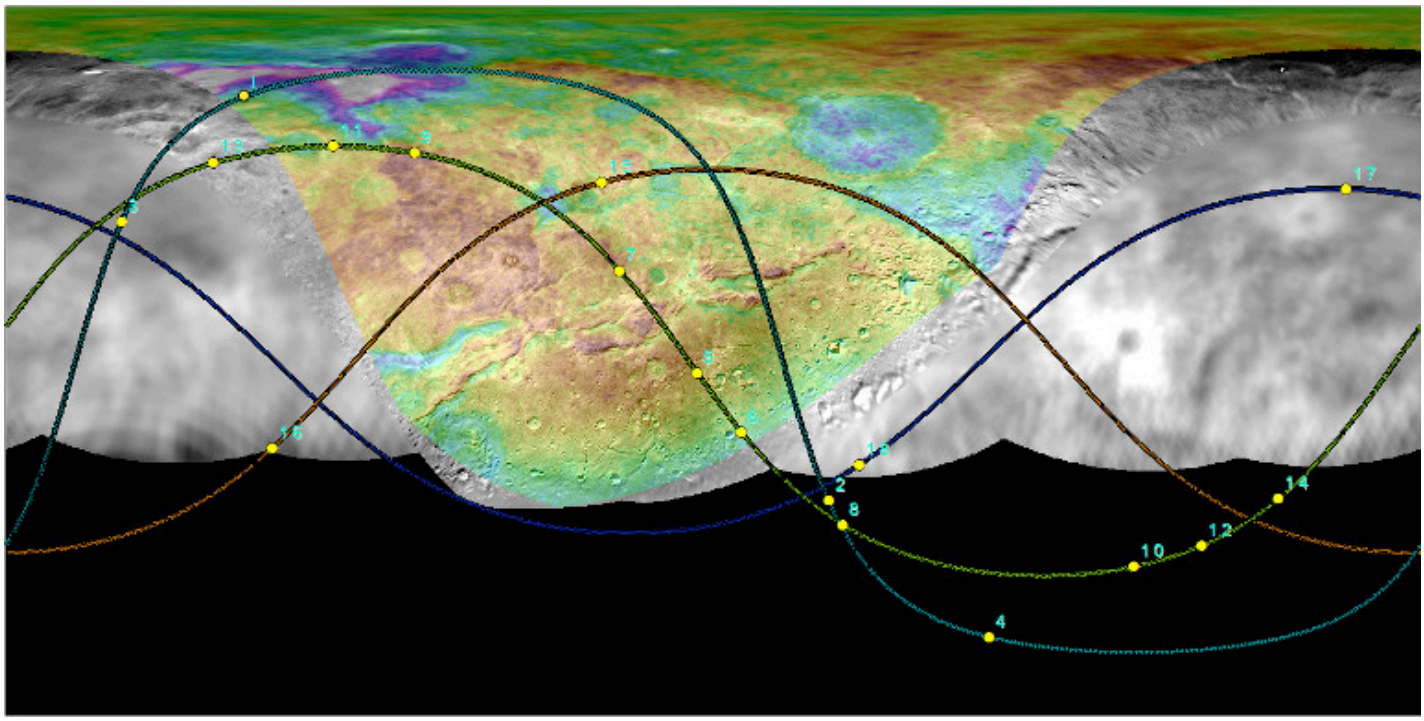

Figure 1: Location of limbs and occultation ingresses and egresses. The SOAR and Gemini South occultations had ingress and egress near sites 11 and 12. Redder areas represent higher elevations. Zero longitude is in the center of the figure.