



## The Bathymetry of a Titan Sea

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We report here on observations from the recent T91 (23th May, 2013) Cassini fly-by of Titan where we acquired nadir-pointed altimetry data across Ligeia Mare, the second largest sea of Titan. The relatively low flyby altitude, combined with data processing to suppress the lateral lobes of the strong surface reflection allowed us to detect subsurface echoes reflected from the bottom of the sea. This detection relies on the remarkable radar-transparency of the liquid, for which we determine a loss tangent of  $3 \pm 1 \cdot 10^{-5}$ . The loss tangent of the liquid is so low that it strongly constrains the composition to be a nearly pure methane-ethane mixture. The presence of nitrogen in the ethane-methane sea, expected based on its solubility and dominance in the atmosphere, is consistent with the low attenuation, but that of substantial dissolved polar species or suspended scatterers is not. Coherent processing of the echoes permitted detection of the bottom along the entire 300 km track across Ligeia and thereby determination of its bathymetry. We found the greatest depth to be about 160-170 m, and a seabed slope that is more gentle towards the northern shore.