MAGNETIC PULSATIONS ON MARTIAN SURFACE: INITIAL RESULTS FROM INSIGHT FLUXGATE MAGNETOMETER. P. J. Chi[1], C. T. Russell[1], S. Joy[1], D. Banfield[2], C. L. Johnson[3,4], Y. Ma[1], A. Mittelholz[3], and Y. Yu[1], [1]Department of Earth, Planetary and Space Sciences, University of California Los Angeles, Box 951567, Los Angeles, CA 90095 (pchi@igpp.ucla.edu), [2]Cornell Center for Astrophysics and Planetary Science, Cornell University, 420 Space Sciences, Ithaca, NY 14853, [3]Department of Earth, Ocean and Atmospheric Sciences, The University of British Columbia, Vancouver, BC, V6T 1Z4, [4]Planetary Science Institute, Tucson, AZ 85719.

Introduction: InSight is the first Mars surface mission that carries a magnetometer, making Mars the third planetary body, after the Earth and the Moon, that has made surface magnetic field measurements. [1] and [2] report the first results from the InSight FluxGate (IFG) magnetometer experiment and the use of IFG measurements to constrain the crustal magnetic field at the InSight landing site.

One of the research topics that can be investigated by using the InSight FluxGate (IFG) magnetometer observations is magnetic pulsations, which frequencies are also known as the ultra-low-frequency (ULF) band that spans between 1 mHz and 1 Hz. Multiple types of magnetic pulsations have been observed on the terrestrial surface, and all of them have origins in the outer space, including the ionosphere, the magnetosphere, and the solar wind. The observation of each type of magnetic pulsations can often imply the occurrence of a specific physical process above the atmosphere [3].

Past and ongoing Mars orbiter missions have observed several types of magnetic pulsations near the planet, such as the upstream waves excited by backstreaming ions from the bow shock [4], impulsive oscillations associated with magnetic reconnection or flux ropes in the induced magnetotail [5, 6], and the Kelvin-Helmholtz instability that occurs due to the shear flow between the solar wind and the induced magnetosphere [7]. Whether any of these magnetic pulsations can reach the Martian surface is an open question.

Observations: We study the initial IFG data that begin on November 30, 2018 to examine whether and what types of magnetic pulsations are present on the Martian surface. We have found continuous pulsations (Pc) with frequencies at ~10 mHz occurring mostly near midnight. Pc at lower frequencies (of the order of 1 mHz) has also been found in local morning. The data from the Temperature and Wind for InSight Subsystem (TWINS) are also studied to examine whether any of the ULF oscillations in the IFG data is caused by the wind-driven motion of the lander or metal parts of the lander.

Discussion: We present initial results concerning the magnetic pulsations observed by InSight. The continuous pulsations found near midnight at the landing site are different from what are typically observed on the Earth surface at the same local time. The different field and plasma environment at Mars raises interesting questions about how the magnetic pulsations in the induced magnetosphere propagate to the surface. Because these ULF waves provide the input energy for the electromagnetic sounding (EMS) of the Martian crust and mantle, understanding the generation and propagation of these waves is important in ensuring that proper boundary conditions are used in future EMS investigations on Mars.

References:

[1] Russell, C. T. et al. (2019), this meeting. [2] Johnson, C. L. et al. (2019), this meeting. [3] Takahashi, K. et al. (2006), *Magnetospheric ULF Waves: Synthesis and New Directions*, geophysical monograph 169, AGU. [4] Russell, C. T. et al. (1990) *GRL, 17*, 897-900. [5] Eastwood, J. P. et al. (2008) *GRL, 35*, L02106. [6] DiBraccio G. A. et al. (2015) *GRL, 42*, 8828-8837. [7] Ruhinusiri S. et al. (2016) *GRL, 43*, 4763-4773.