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## The Polarization of Ambient Noise on Mars

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Seismic noise recorded at the surface of Mars has been monitored since February 2019, using the InSight seismometers. This noise can reach -200 dB and is 500 times lower than on Earth at night and it increases of 30 dB during the day. We analyze its polarization as a function of time and frequency in the band 0.03-1 Hz. We use the degree of polarization to extract signals with stable polarization independent of their amplitude and type of polarization. We detect polarized signals at all frequencies and all times. Glitches correspond to linear polarized signals which are more abundant during the night. For signals with elliptical polarization, the ellipse is in the horizontal plane below 0.3 Hz (LF). Above 0.3 Hz (HF) and except in the evening, the ellipse is in the vertical plane and the major axis is tilted. While polarization azimuths are different in the two frequency bands, they both vary as a function of local hour and season. They are also correlated with wind direction, particularly during the daytime.

We investigate possible aseismic and seismic origins of the polarized signals. Lander or tether noise can be discarded. Pressure fluctuations transported by wind may explain part of the HF polarization but not the tilt of the ellipse. This tilt can be obtained if the source is an acoustic emission coming from high altitude at critical angle. Finally, in the evening when the wind is low, the polarized signals may correspond to the seismic wavefield of the Mars background noise.

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