Polarized ambient noise on Mars

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Abstract

Seismic noise recorded at the surface of Mars has been monitored since February 2019, using the seismometers of the InSight lander.

The noise on Mars is 500 times lower than on Earth at night and it increases during the day. We analyze its polarization as a function of time and frequency in the band 0.03-1Hz. We use the degree of polarization to extract signals with stable polarization whatever their amplitude. 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 with clockwise and anti-clockwise motion at low frequency (LF).

At high frequency (HF), the ellipse is in the vertical plane and the major axis is tilted with respect to the vertical. Whereas polarization azimuths are different in the two frequency bands, they are both varying as a function of local time and season. They are also correlated with wind direction, particularly during the day.

We investigate possible aseismic and seismic origin of the polarized signals. Lander or tether noise are discarded. Pressure fluctuation transported by environmmental 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 in some particular case. Finally, in the evening when the wind is low, the measured polarized signals seems to correspond to a diffuse seismic wavefield that would be the Mars microseismic noise.