



## **Using Zeeman effect on molecular oxygen to measure Mars' crustal magnetism: Sensor requirements from simulated signal strengths**

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Mars has no internal magnetic dipole. Instead, its magnetism is present in crustal fields located primarily in the southern hemisphere. In small areas near the surface, the Martian magnetism is close in strength to equatorial Earth's magnetic field. Measurements of the lower altitude magnetism are not available, but detailed measurements at lower altitudes would put stronger constraints on models of past geology.

The Zeeman effect changes the spectroscopy of molecular oxygen by splitting a line into several polarized lines. This splitting on Mars is likely smaller than the thermal broadening, so to measure the magnetic signal, a polarized approach is necessary.

We show by simulations how large this signal is expected to be for measurements near in frequency to a few molecular oxygen lines. The signal is expected to be large enough for modern receiver technology to measure it at high signal-to-noise ratio for short integration times. Some limitations and optimal design of such a sensor is discussed.