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Study of the rotation of Mars through radioscience between lander/rover and the Earth

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Abstract

In the frame of the future missions to Mars, geodesy radioscience with lander/rover will be studied with particular focus on furthering our understanding of the interior, rotation and orientation of this terrestrial planet. We simulate Doppler observations of radioscience instruments and show how well the rotation and orientation of Mars can be determined. Figure 1 shows the contribution of the semi-annual length-of-day variation to the Doppler shift as measured by an X-band radiolink on an equatorial lander.

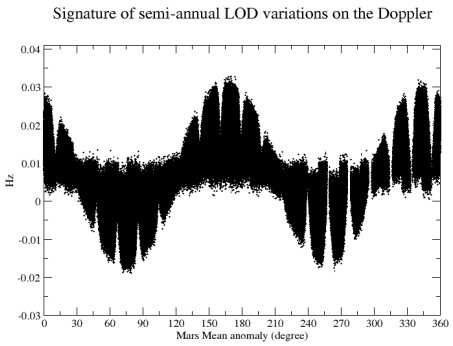

Figure 1: Contributions of the semi-annual length-of-day variation to the Doppler shift as measured by an X-band direct-to-Earth radiolink for an equatorial lander

Figure 2 and Figure 3 show the contributions to the Doppler for the same direct-to-Earth link of the semi-annual prograde nutation and ter-annual retrograde nutation.

We additionally show therewith the properties of the deep interior and of the global atmosphere of Mars that can be obtained. In particular, the contribution of the seasonal length-of-day variation to the Doppler shift as measured by an X-band radiolink on an equatorial lander and an equatorial rover is presented. In parallel, we study the contributions to the Doppler for the same direct-to-Earth links of the semi-annual prograde nutation and ter-annual retrograde nutation.

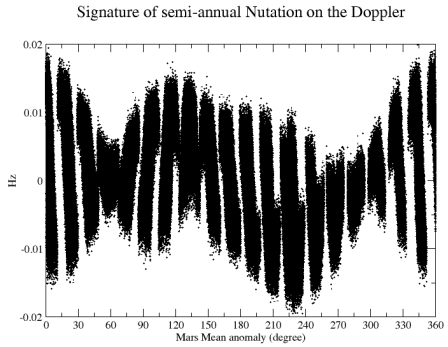

Figure 2: Contributions of the semi-annual prograde nutation to the Doppler shift as measured by an X-band direct-to-Earth radiolink for an equatorial lander

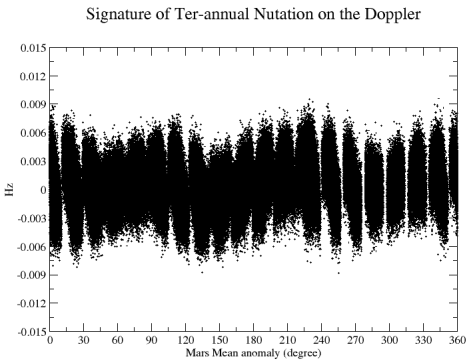

Figure 3: Contributions of the ter-annual retrograde nutation to the Doppler shift as measured by an X-band direct-to-Earth radiolink for an equatorial lander