Exploration of Mars Internal structure by inverse VLBI technique

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VLBI (very long baseline interferometry) technique is anticipated to be applied for precise positioning of an orbiter or a lander in lunar and planetary explorations. VLBI measures a difference in an arrival time of a signal transmitted from a radio source to two ground stations. The differential VLBI (DVLBI) measurement consists of the differenced delay between two radio sources (orbiter-orbiter or orbiter-quasar). The differential delays give plane-of-sky position differences of two radio sources in contrast to conventional 2-way Doppler measurements that give line-of-sight position information. The combination of VLBI with Doppler can be used for gravity field estimation of the Moon and planets, and for determining their rotations through the precise positioning of orbiters or landers.

This presentation shows the application of VLBI technique for next Mars landing missions. We planned to apply VLBI technique for next lunar and planetary missions. Inverse VLBI observations are proposed for a lunar landing mission (SELENE-2) and a Mars landing mission. The purpose of these observations is to investigate the internal structures through the estimation of the rotation changes of the Moon and Mars those are the precession, nutation and polar motion. We use multi-landers and measure the difference of the distances between landers and a ground station in order to estimate the rotation of the Moon and Mars. The inverse VLBI can also be applied for the gravimetry of the Moon and Mars with same beam VLBI technique. These VLBI techniques are expected to contribute the understanding of the internal structure and leading the origin and thermal evolution of the Moon and planets.