Lunar surface control network with retro-reflectors and radio transponders in Chang'E lunar missions

Jinsong PING, Mingyuan WANG, Wenxiao LI, Jing SUN
National Astronomical Observatories, CAS, Beijing, China, jsping@bao.ac.cn

The lunar laser ranging technique has been used for 50 years, on defining a lunar surface control network, and on improving a lunar-earth ephemeris with dramatic accuracy. Also, this method has been used to study the lunar inner structure when monitoring the lunar rotation variation. The general relativity has been tested with very high precision.

Taking into the power issue into consideration, the LLR method using passive reflection idea is a best choice on constructing a lunar surface network. Recently, teams from CAS are developing and testing the LLR ground systems. Yunnan Astronomical Observatory has received the return photon successfully at 532nm, after 30 years effort.   LFN in Italy has been made the world top qualified optical retro-reflectors, which can be used for the future lunar landing missions.

However, the current reflectors on the moon surface cover only a very limited area with dimension no larger than 1500km of near side. Many researchers are suggesting a larger coverage extending to the polar areas and whole the rim seen from the Earth. In China lunar exploration series, the CE-6 and the planned CE-7 may be set at lunar polar area, which will be pioneer work(s) to meet this requirement. Also, an updated lunar surface optical retro-reflector network can be used to improve the knowledge of lunar solid physics and dynamics powerfully. A joint collaboration of using best reflector on CE-6 and CE-7 is promoted by both sides together.

Besides the optical retro-reflectors for the lunar control network, radio instruments have also been used in China lunar surface mission like CE-3, both of radio transponder and beacon set one the lander are still working. VLBI, Doppler and radio phase ranging have been used to measure the lander position and Earth-Moon dynamical parameters.