Albedo/color variation on Mercury due to space weathering

S. Sasaki (1)

(1) RISE Project Office, National Astronomical Observatory of Japan, Oshu, Japan (sho@miz.nao.ac.jp/Fax:+81-197-22-7120)

Space weathering is a proposed process to explain spectral mismatch between lunar soils and rocks, and between asteroids (S-type) and ordinary chondrites. Hapke et al. (1975) proposed that the space weathering is caused by formation of nanophase iron particles in soil coatings from the deposition of ferrous silicate vapor. High-velocity dust impacts as well as sputtering by solar wind would be responsible for vapor formation. Space weathering should be ubiquitous process on airless bodies including Mercury. Since impact flux and velocity of dust particles on Mercury would be much higher than those on the moon and asteroid, spectral darkening and reddening on Mercury should be faster.

Mariner 10 observation and recent ground-based observations suggested the surface reddening on Mercury. However, there are a number of impact craters associate with bright ejecta and rays. Impact process should have excavated underlying fresh material, but Mercury has more craters with brighter ejecta/rays than the moon has. This might not imply expected rapid surface weathering. One possibility is that actual dust flux would be lower than the predicted value because of interplanetary dust disruption processes. Another possibility is that higher surface temperature might decrease the optical effect by growing nanophase iron particles. The other possibility is lower surface abundance of Fe. But probably the most significant effect is the impact gardening process which would have weakened the surface maturity. On Mercury higher impact flux and velocity of impacting meteoroids would stir the surface regolith more effectively than on the moon, which may moderate observed spectral change.

Spectral observation of Mercury by future missions such as Messenger and Bepi-Colombo would clarify the space weathering rate in comparison with relative crater density age. MDM (Mercury Dust Monitor) on board BepiColombo will clarify flux and velocity of dust causing space weathering.