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Simulation on the ratio of sodium to potassium in the exosphere of Mercury

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The ratio of sodium to potassium in the exosphere of Mercury is higher than that on other solar system planets. However, previous studies have not revealed the cause of such high Na/K ratio. The purpose of this study is to investigate the cause of observed high Na/K ratio by means of simulation.
Proposed source processes of Mercury's exosphere are thermal desorption, photo-stimulated desorption, micro meteorite vaporization and solar wind sputtering. Major loss process is photoionization. Because atoms in the exosphere of Mercury are ejected from the surface, the Na/K ratio in the exosphere will reflect the ratio in the surface if the production and loss rates for sodium and potassium are identical. However, since such high Na/K ratio on the surface seems not plausible, the observed Na/K ratio suggests that the production and loss rates for sodium and potassium are different.
It is possible that the Na/K ratio is affected by not only the difference in production rates and the lifetime of photoionization, but also by reimpact of ions onto the surface and/or the existing fraction of atoms on the surface. We use the existing fraction of atoms on the lunar surface for the present study because that on Mercury is not known get. It is expected that more sodium ions reimpact than potassium ions due to the difference in their gyroradius, and therefore we especially take into account this effect in our simulation.

Keywords: Mercury, sodium, potassium