

SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 3 (2C)

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## STUDIES ON THE RE-ENTRY ANGLE OF LUNAR PROBES

**Abstract**

The re-entry angle is the angle between the velocity and the ground plane at the re-entry point when a spacecraft returns to the earth. Neglecting the non-spherical gravitation of the earth, it can be taken as the angle between the velocity and the tangent direction of the orbit at the re-entry point. Generally, the re-entry angle should be small to avoid the aerodynamic heating problem. Taking the Hohmann transfer orbit as an example, this paper studies the relations between the re-entry angle and the rotation of the earth, along with the revolution of the moon. Theoretical analysis and numerical simulations leads to the following results.

- (1) For a fixed transfer time and a fixed re-entry point, the minimum of the re-entry angle could be reached only when the moon is at the southern peak of its orbit;
- (2) For a fixed transfer time and a fixed re-entry angle, the maximum of the latitude of the re-entry angle could be reached only when the moon is at the southern peak of its orbit;
- (3) The shorter the transfer time, the smaller of the minimum of the re-entry angle and the larger of the maximum of the latitude.
- (4) If the re-entry point has a high, latitude and the re-entry angle is too small, a hohmann orbit back from the moon couldn't be found. Extremes of the values above are reached only when the orbit at the re-entry point is a polar orbit.