INITIAL ORBIT DETERMINATION OF CISLUNAR OBJECTS USING ONLY OPTICAL DATA

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Abstract: Till now human beings have carried out more than one hundred lunar missions, leaving junks at the translunar orbits. Currently there are several probes moving in the cislunar space, and there is a growing interest on sending more artificial objects to this space. It can be expected that in the near future the cislunar space is more crowded than its current status. Also, natural bodies of meter size or smaller have chances to enter the cislunar space from the interplanetary space. Given the fact that objects in the cislunar space are generally far from ground stations, optical survey is a reasonable choice for objects in the cislunar space. Period of cislunar objects is usually measured in month, so an observation arc lasting less than one hour is only one of several hundreds of the orbit. This is a typical very short arc initial orbit determination problem, which is already difficult to be solved. What makes the problem more difficult is that some cislunar objects do not follow the two-body law, such as objects close to the libration points. Based on simulated ground-based observation data of an object on one L1 halo orbit, we study the initial orbit determination problem in two ways, one is a modified form of the Laplace method, and the other is based on the attributes and the feasible region method. A comparison is made on the performance of both methods.

Speaker: Xiyun Hou is currently a full-time professor at School of Astronomy and Space Science, Nanjing University, China. His research interests are related with both celestial mechanics and astrodynamics, including libration point, periodic orbit and resonance, orbit design and stationkeeping, orbit determination and navigation, and planetary defense.