
Lunar impact flashes: Physical properties of the impactor and link to craters.

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Résumé

Observing live the meteoroid impacts on the Moon we are now able to infer the physical properties of the small impactors. Furthermore, by identifying and measuring the respective crater we can inform impact scaling laws as well as we can constrain better the luminous efficiency, which is the fraction of the meteoroids kinetic energy that converts to light upon impact. Lunar surface provides an excellent opportunity to study meteoroid impacts, due to the proximity to Earth and to the lack of atmosphere. In a broader picture, we can consider those impacts are an extension in size and energy scales of the current laboratory impact experiments using light-gas guns, where masses are up to a few grams and velocities limited to ~ 8 km/s. With the support from PNP since 2019, our team developed methods to detect in real time the lunar impact flashes in telescope images, to derive the selenographic coordinates of the events and to identify the origin of each meteoroid impactor. Moreover, we have developed through the years methods to measure the temperatures of lunar impact flashes as well as the mass of the meteoroid. We retrieved from the literature the lunar impact flash observations of the last 20 years, and we constructed the peak temperature distribution of those events, when possible, which is in great agreement with the theoretical estimations by previous studies. We also constructed the size distribution of the cm-dm meteoroid impactors and we found that it is very similar to the one derived from the fireball data of the Canadian camera network. In addition, our team developed the PYNAPLE algorithm to identify the fresh craters on the lunar surface using the LRO data and searching around the coordinates of the reported lunar impact flashes. Here we report the first crater detection following this method. PYNAPLE will become a publicly available tool for all the lunar observers.

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