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Impact frequency on the Moon and the Moon micro-seismic noise

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The frequency/size law of meteoroids impacting the Moon and the associated probability of NEO impacts are still not known precisely. Uncertainties as large as a factor of 3-5 remain, especially for the moderate-sized impacts which are not observed on the Earth, due to the shielding by the atmosphere. Impact frequencies of these objects are made from the observation of larger impacts by the US DSP satellites, recording of luminous flashes or extrapolation of cratering frequencies. We provide here an estimate of the impact frequency, by analysing events recorded during the Apollo Passive Seismic Experiment in a statistical way. Our method is summarized as follows. We used artificial impacts performed during the Apollo program to build a method able to compute the seismic waveform generated by an impact at any epicentral distance and with a given mass and impactor velocity. We then use meteoroid mass/frequency laws to generate, with a random simulator, a history of impacts on the Moon during a given period. We compute the seismic signals generated by succession of seismic sources and estimate the frequency/amplitude relationship of such seismic signals. Our results also provide an estimate for the meteoritic seismic background on the Moon. This background noise was not recorded by the Apollo seismic experiment due in-sufficient resolution. Such an estimate can be used in designing a new generation of lunar seismometers, for estimating the probability of detecting proposed impacts due to nuggets of strange quark matter, and to inform future lunar based experiments, which require very stable ground, such as optical interferometry moon-based telescopes or gravity waves detectors.