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IS THERE A PREFERED DATE FOR A POSSIBLE IMPACT?

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ABSTRACT

The distribution of observed meteors along the year has two main components: sporadic meteors and those associated with meteor showers. The meteor showers peaks in very specific dates, but they do not pose a threat to human beings because they are associated with the fluffy particles sprinkled by a comet during the perihelion passages. Among the sporadic meteors, we highlight those producing bright fireballs and delivering meteorites on the Earth surface. Those cases are definitively related to a rocky meteoroid.
A concentration of meteorite falls in a particular date could be an indication of the existence of a stream of rocky asteroids sharing a similar orbit. The stream should be the outcome of a recent fragmentation process, possibly even during the NEA-phase. A few of the more abundant small fragments might have already fall to the Earth, but a larger body could still be waiting to be discovered.
In order to test this hypothesis, we make use of the existence information on meteorite falls.
The worldwide accepted clearing-house of meteorites is the Meteoritical Society, which maintains the Meteoritical Bulletin Database (hereafter MBD), a collection of information about recovered meteorites from all over the world. Up to end 2018,

there are almost 60.000 registered meteorite names with their respective taxonomic classification.
Meteorites recovered following observed passage through the atmosphere are called falls; while those which are serendipitously found or they cannot definitely be associated with a passage are called finds. In the MBD there are 1170 registered meteorites falls with official names. We combine the information of the MBD and other databases to analyze the time distribution of meteorite falls. The database includes information of falls extended for several centuries, but with a uniform coverage over the last century. We compute the frequency of falls as a function of the day of the year and the Sun's longitude. The frequency is compared with a Poisson process to look for dates with a frequency larger than expected; which it could be a signal of a meteorite stream. We found a few high peaks in the frequency distribution, but those are not significant; they rather represent the tail of a Poisson distribution. Nevertheless, we analyze the individual falls under those peaks and we compare the information about the meteorites and the fireball orbits.

As a preliminary conclusion, we do not find any heavily populated meteorite stream and there is no preferable date for an impact.

A subset of the meteorite falls that generate a lot of concern are those meteorites that directly impact human beings or their belongings, we call them “damaging falls”.
From an analysis of the registered meteorite falls and the damaging subset in the last century, we calculate an average rate of 7.25 falls and 1.25 damaging falls over the urban land per year registered in the database. We then estimate ~5600 meteorite falls per year over the entire Earth and ~1600 over the land. These numbers are relevant to estimate the risk posed by the very small impacts.

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