Meteor storm evidence against the recent formation of lunar crater Giordano Bruno

(Close to publication in Meteoritics, editor says “it’s about ready to go”)

It has been suggested that the formation of 22 km lunar crater Giordano Bruno was witnessed in June 1178 AD. A dramatic passage in the medieval chronicles of Gervase of Canterbury speaks of the crescent Moon "spewing out fire, hot coals, and sparks," a potentially plausible description of an impact on the Moon. Based on its extensive pattern of bright rays and uneroded morphology, Giordano Bruno is the youngest crater of its size or larger on the Moon. Its position just beyond the north-eastern limb of the Moon is consistent with some details in the passage, and this and its youth led Jack Hartung, in 1976, to suggest it as the impact site.

A large impact on the Moon in historical times, if proven, is interesting for the following reasons:
1) Study of an effectively uneroded impact crater will improve our knowledge of this important geological process.
2) The medieval Earth narrowly avoided (cosmically speaking) a climatic catastrophe with which it was ill-equipped to deal, and which would have drastically altered the development of modern civilization.
3) Such an event is predicted to occur on timescales of millions of years. Such a recent impact would challenge current models of the near-Earth asteroid population.
4) Great tool for education and public outreach.

Few tests of this hypothesis have been proposed. In the scientific literature, it is generally considered an intriguing, improbable idea. It has been uncritically accepted as fact in other areas. A large impact on the Moon would deliver ejecta to the Earth, generating a meteor storm. This presentation outlines a calculation of the properties of the meteor storm associated with Giordano Bruno.

In a Meteoritical Society abstract of 1991, Gault and Schultz state that the Earth would have accreted 10 million tonnes of Giordano Bruno ejecta in the week after its formation. No further details were given, and this was one of the last publications of Gault's career.

ASSUMING the above to be correct, and ASSUMING a uniform distribution of ejecta of the surface of the Earth and the week-long interval, and ASSUMING a characteristic ejecta size of 1 cm, an observer would see 50 thousand magnitude 2 meteors per hour at NIGHT.

Ejecta in ejecta blankets typically has a power-law distribution weighted such that most of the ejecta mass is in the largest objects. However, such distributions are inappropriate for a velocity-selected portion of the ejecta. Crude studies of secondary craters suggest that the largest fragment to reach escape velocity is about 10 cm in size. Theoretical studies of high speed liquid drops are consistent with this, but I'm having some trouble getting it past Bill Hartmann (Meteoritics editor).

The alleged impact occurred when the Moon was about 1.5 days old. This raises the question of whether any of the ejecta arrived at night. I performed a crude calculation that suggested that an ejection angle of 45' and ejection speed of a few km s-1 could deliver ejecta to the nightside of the Earth. Satisfied that at least some of the ejecta would arrive in the dark, and feeling that a more accurate calculation was inappropriate for the current work, I left it there.

Given a characteristic ejecta size of cm-scale and a few % of the ejecta arriving at night, the resultant meteor storm is superlative enough to be recorded in many chronicles. No such records are found, hence the meteor storm did not occur in 1178AD and the crater did not form then.