Impact and recovery of asteroid 2018 LA

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Asteroid 2018 LA

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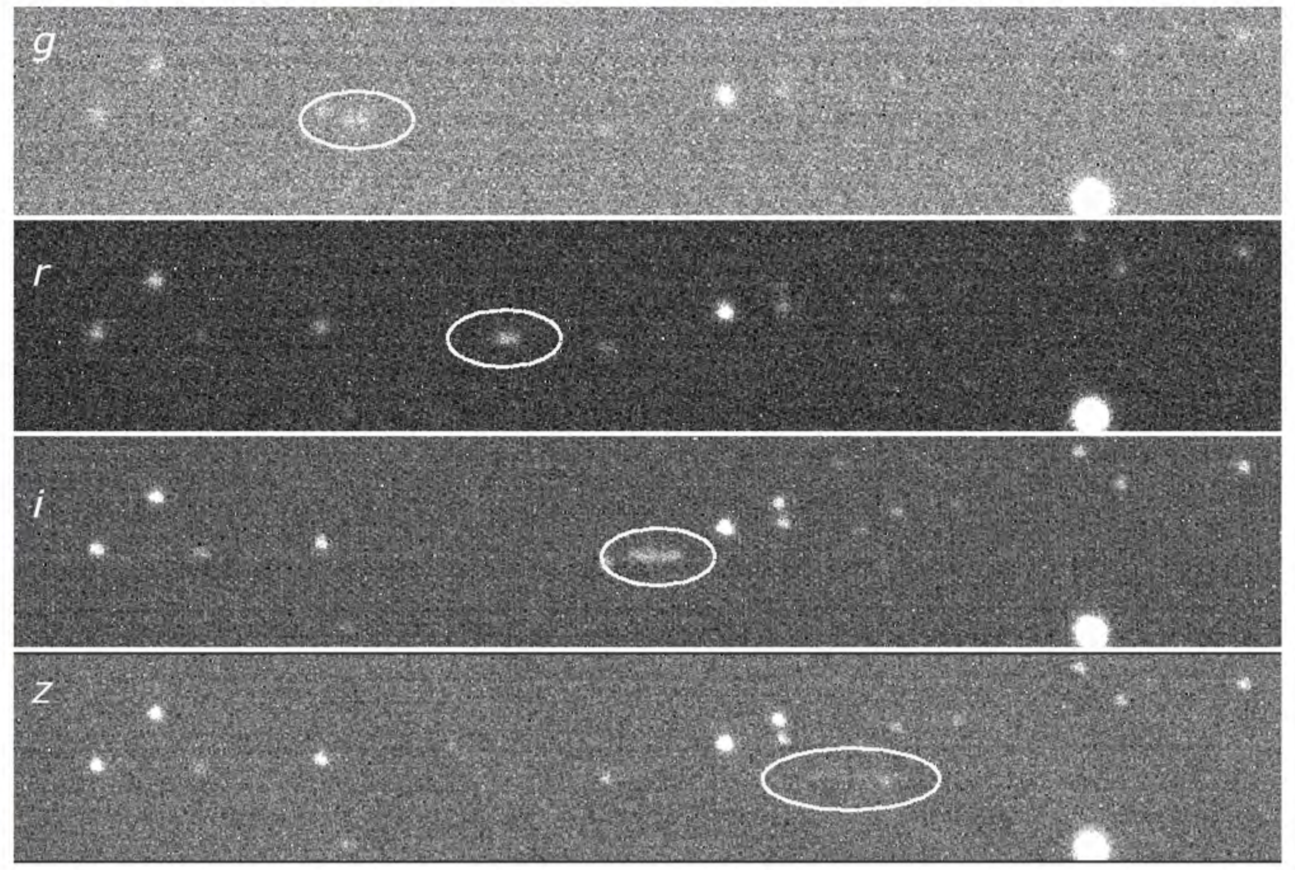
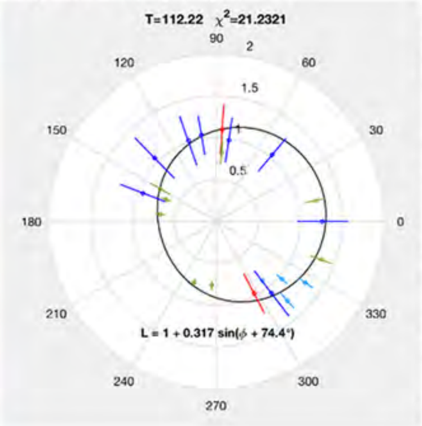


New detection: asteroid 2018 LA in SkyMapper Survey data.

On June 2, 2018, asteroid 2018 LA was detected by the Catalina Sky Survey on an impact trajectory, 8 hours before possible impact. A video security camera in Ottosdal, South Africa, recorded a bolide over Botswana. ATLAS survey data extended the observing arc. Here, we report on additional detections in the SkyMapper Survey data that extend the observing arc to 5.4h, improve the orbit and enable an approximate determination of the asteroid's spin period and shape.

Asteroid brightness as function of phase in spin period:



Best sinusoidal fit to the lightcurve for triaxial ellipsoid c/b = 0.58.

Spin period = 224 +/- 40s.

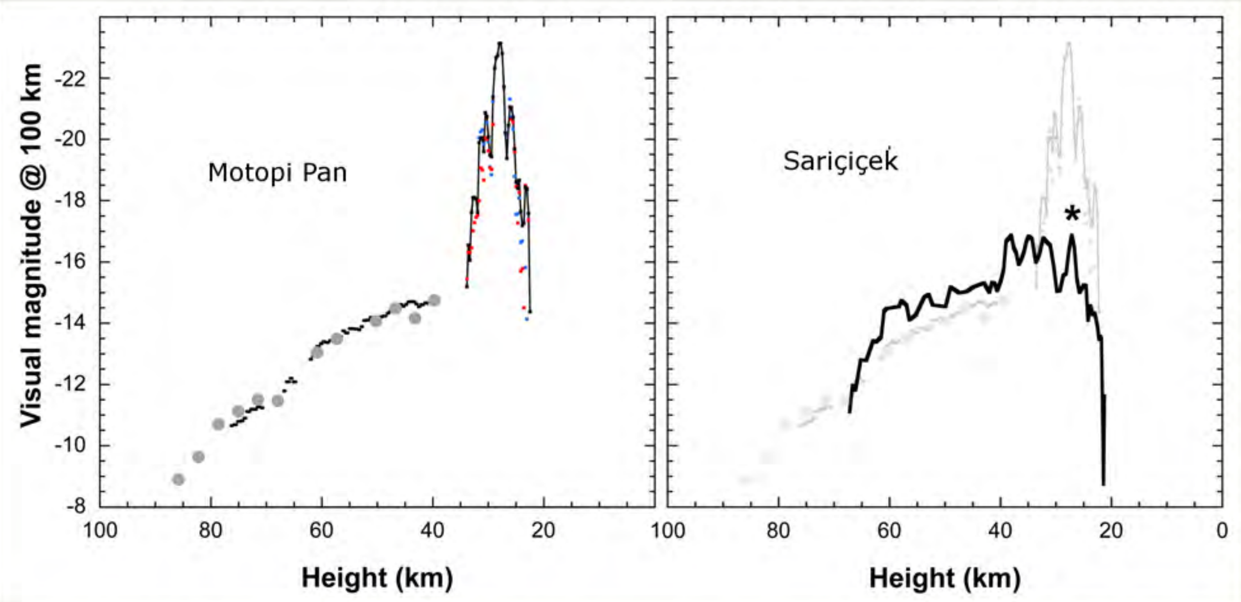
Combining astronomical brightness data with data from meteorite analysis shows most likely size = 156 cm diameter, V-class spectrum with 25% reflectivity, and no opposition effect.

#2! Mohutsiwa Gabadirwe of the Botswana Geoscience Institute recovers the second Motopi Pan meteorite. This is also the second recovered fall from a small observed asteroid, after 2008 TC3 ten years earlier. From left to right: Peter Jenniskens, Tim Cooper, Mohutsiwa Gabadirwe, Kabelo Dikole, and Thebe Kemosedile.

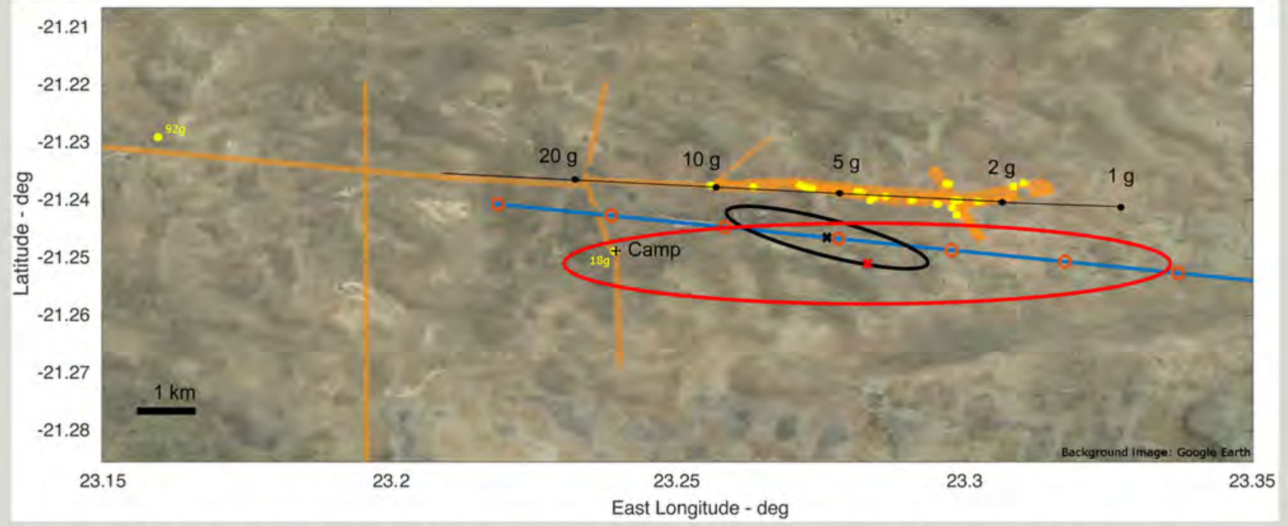
Recovery

Contributions by: Peter Jenniskens, Alexander Proyer, Mohutsiwa Gabadirwe, Oliver Moses, Tomas Kohout, Fulvio Franchi, Esko Lyytinen, Jarmo Moilanen, Jim Albers, Tim Cooper, Jelle Assink, Läslo Evers, Panu Lahtinen, and Lesedi Seitshiro

Video security camera footage from Ottosdal, Gaborone, Maun, Rakops and Ghanzi was calibrated to triangulate the fireball disruption. From that position, using wind model data, the fall area was calculated. First meteorite found on June 23, 2018 by Lesedi Seitshiro of BIUST.



Fireball lightcurve showed a prominant flare, much stronger than seen in Sariçiçek. Same disruption altitude: 27.8 ± 0.9 km.

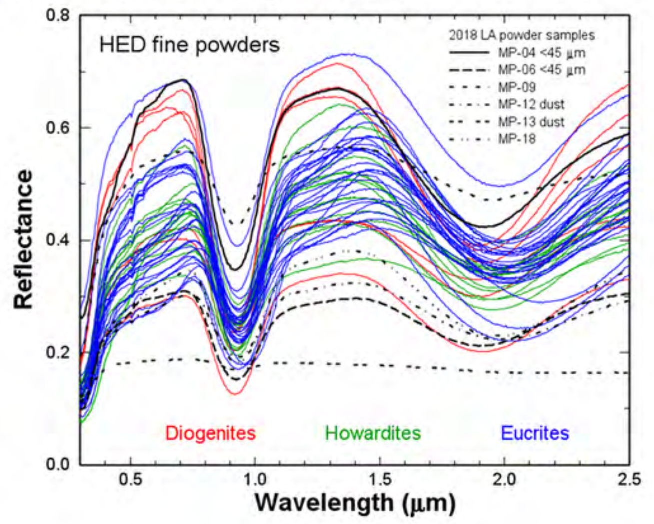


Fall area in Central Kalahari Game Reserve in central Botswana. Red ellipse is the position of the flare estimated by video triangulation. Black ellipse is the position of the flare after taking into account the asteroid astrometry. Blue line shows the ground-projected path, with orange circles marking 10-km steps in altitude. Thin black line is the calculated fall line. Orange areas were searched, yellow dots are finds.

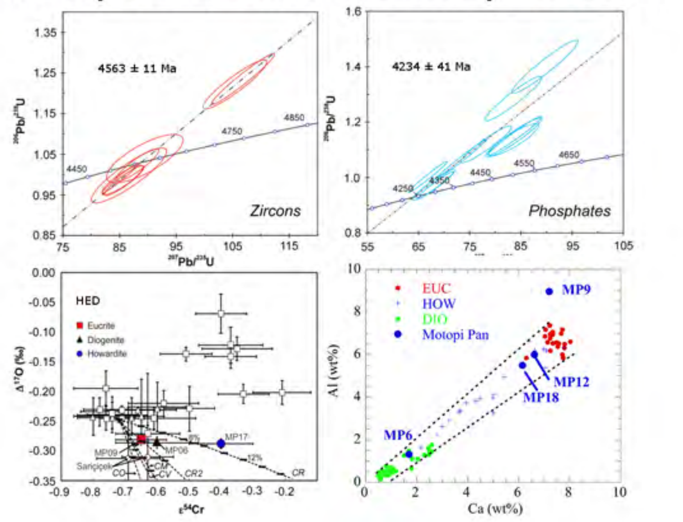
Planetary Defense

Contributions from: Matthias Laubenstein, Nggie Wantlo, Phemo Moleje, Joseph Maritinkole, Heikki Suhonen, Michael E. Zolensky, Roger L. Gibson, Lewis Ashwal, Takahiro Hiroi, Derek W. Sears, Alexander Sehlke, Alessandro Maturilli, Qing-zhu Yin, Matthew E Sanborn, Magdalena H. Huyskens, Supratim Dey, Karen Ziegler, Henner Busemann, My E. I. Riebe, Matthias M. M. Meier, Kees C. Welten, Marc W. Caffee, Qin Zhou, Qiu-Li Li, Xian-Hua Li, Yu Liu, Guo-Qiang Tang, Hannah L. McLain, Jason P. Dworkin, Daniel P. Glavin, Philippe Schmitt-Kopplin, Hassan Sabbah, Christine Joblin, Mikael Granvik, Babutsi Mosarwa, and Koketso Botepe.

Reflectance spectra:

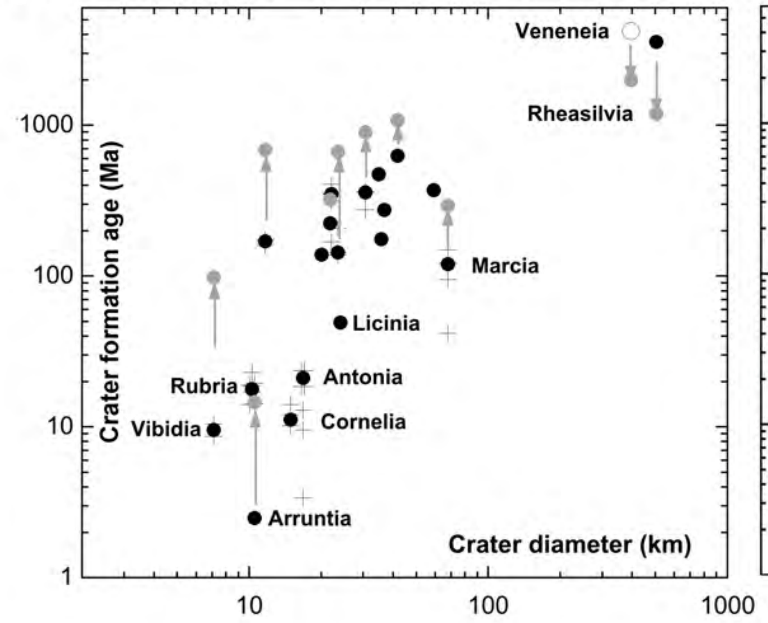


Isotopic & elemental compositions:

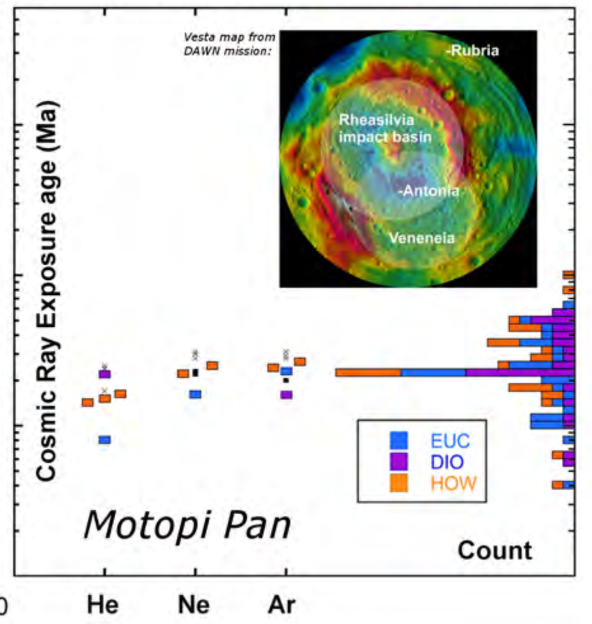


Analysis of 7 meteorites showed these were part of a HED polymict breccia derived from howardite, cumulate and basaltic eucrite, and diogenite lithologies. Some similarities and some differences with howardite Sariçiçek were noticed.

Vesta crater age versus size:



Age distribution of known HED:



Orbit of 2018 LA is consistent with origin at Vesta (small a, low i). Cosmic ray exposure age is 23 ± 4 Ma, similar to HED Sariçiçek (thought to have originated at the Antonia impact crater). Unlike Sariçiçek, Motopi Pan experienced a heating event 4234 ± 41 Ma ago, possibly from formation of Veneneia impact basin. Later formation of Rheasilvia spread this material around. On top of Rheasilvia ejecta is 10-km sized crater Rubria, a good candidate for the origin crater.

Acknowledgements & further reading: