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THE IMPACT OF SMALL NEAR-EARTH ASTEROID 2018 LA

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ABSTRACT

2018 LA was an asteroid of few meters in size discovered by the Catalina Sky Survey on 2018 June 2 at 08:15 UT near the opposition at one lunar distance from the Earth. Before the object set below the horizon, the Catalina Sky Survey obtained eleven astrometric observations over one hour and a half that were promptly reported to the Minor Planet Center. Once the astrometry became publicly available, JPL's Scout system identified a 5% probability that 2018 LA could reach the Earth within hours of discovery, from 13:30 UT to 17:15 UT. The impact corridor extended from the Pacific Ocean east of Papua New Guinea to the Atlantic Ocean west of Namibia. The remeasurement of the initial astrometry and the report of a twelfth detection by the Catalina Sky Survey increased the impact probability to 30%. Because of the short observation arc and the proximity of 2018 LA to the Earth, the plane-of-sky uncertainties were large and so no targeted additional observations were made before 2018 LA actually reached the Earth around 16:45 UT. Within a

few hours of the impact, the event was confirmed by independent sources. First, eyewitnesses reported a fireball sighting to the American Meteoritic Society. Moreover, before knowing that the impact had taken place, we searched the images of the ATLAS survey and found two astrometric detections obtained at about 12 UT. Because clouds prevented ATLAS from obtaining its usual four images (and automatically flagging 2018 LA as a candidate NEO), these two detections had to be manually extracted based on the asteroid's expected plane-of-sky location. The ATLAS astrometry confirmed that the impact must have taken place between 16:30 UT and 17:00 UT, with an impact footprint extending from Mozambique to the Atlantic Ocean off the western coast of Namibia. Finally, the Comprehensive Nuclear-Test-Ban Treaty Organization's I47 station in South Africa detected a strong infrasound signal of a bolide over Botswana. On June 5, a release of data provided by US Government sensors reported a fireball event with an impact energy of 0.98 kt corresponding to the impact of 2018 LA. The peak brightness was at 16:44:12 UT at an altitude of 28.7 km, a longitude of 23.3 deg E, and a latitude of 21.2 deg S. The impact velocity was 17 km/s and the entry angle 24 deg above the horizon.

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