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The Minor Planet Center Data Processing System

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ABSTRACT

The Minor Planet Center (MPC) is the international clearing house for all ground-based and space-based astrometric and radar observations of asteroids, comets, trans-Neptunian objects, and outer satellites of the giant planets. The MPC assigns designations, provides up-to-date ephemerides, and coordinates follow-up observations for these objects. The MPC currently receives and processes over two million observations per month and maintains a catalog of orbits of more than 800,000 objects. Although the MPC processes observations of all minor solar system bodies, its focus is near-Earth objects (NEOs). All MPC operations are organized around this central function. The MPC is required to warn of NEOs approaching within 6 Earth Radii within the coming 6 months. Thus, the main components of the MPC's data processing system enable real-time identification of candidate NEOs, with possible impact trajectories, within a much larger volume of asteroids and other solar system objects. A few such alerts are issued each year, including that for ZLAF9B2/2018 LA. In addition, the MPC facilitates follow up

observations and the coordination of observing assets for efficient recovery searches for NEOs. We anticipate that the data volume will increase by a factor of 10 to 100 over the next decade as surveys such as LSST and NEOCam come online, augmenting the already-large volume from programs such as Pan-STARRS, the Catalina Sky Survey, NEOWISE, and ZTF. Thus, we are in the process of building and testing a new MPC data processing system. The goals are to maximize accuracy, data accessibility, automation, and uptime while minimizing latency and maintaining dependable archives of all data received. I will highlight the challenges faced by the MPC, demonstrate the key components of our data processing system, and describe a number of algorithmic advances that support a much more efficient and reliable system. The MPC operates at the Smithsonian Astrophysical Observatory, part of the Harvard-Smithsonian Center for Astrophysics (CfA), under the auspices of the International Astronomical Union (IAU). The MPC is 100% funded by NASA as a functional sub-node of the Small Bodies Node (SBN) of the NASA Planetary Data System at U. Maryland.

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