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AN AUTOMATED SYSTEM FOR SHORT-TERM IMPACT WARNING

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ABSTRACT

The possibility that newly-discovered asteroids could impact the Earth within days or weeks of their first detection raises a number of challenges, from tracking and orbit estimation, to prediction and hazard assessment, and even for public communication and disaster response. Here we focus on the astrodynamics problem of identifying and analyzing potential near-term situations requiring a rapid response, both in the observer community and in the orbit arena.

The observations for such cases will often include only an hour or so of tracking, leaving severe degeneracies in the orbit estimation. We get around this problem through a technique known as systematic ranging, which explores the poorly constrained space of range and range rate to the observer, while the plane of sky position and motion is readily derived from the input observations. A raster scan in the two-dimensional range-range rate space allows us to identify regions in the space of possible orbits corresponding to collision solutions. From this scan we can understand the possible impact times and locations, and even derive coarse estimates of impact probability. To demonstrate the technique, we will review a few recent cases of interest, e.g., 2004 AS1, 2004 FU162, 2008 TC3 and 2014 AA.

We report on efforts to develop and operate a fully automated short-term impact warning system that employs the systematic ranging technique. The system makes use of the latest information available from the Minor Planet Center's NEO Confirmation Page (NEOCP). Whenever an object is added to the NEOCP or the data for an existing object is updated the hazard assessment is recomputed within minutes. All results indicating a possibility of near-term impact are immediately relayed to us by email and more interesting cases are also transmitted by SMS text message. The system is currently operating in private testing mode, but we anticipate making the real-time results public in the near future.

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