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(99942) APOPHIS

J. D. Giorgini, L. A. M. Benner, S. J. Ostro, Jet Propulsion Laboratory; M. C. Nolan, Arecibo Observatory; and M. W. Busch, California Institute of Technology, report: "Arecibo (2380-MHz, 12.6-cm) radar observations of (99942) Apophis = 2004 MN_4 (cf. *IAUC* 8477) made during Aug. 7.655-7.769 UTC produced a CW detection and a Doppler measurement of 8186.8 Hz at Aug. 7.713, a correction of +0.3 ± 0.2 Hz (+18.9 ± 12.6 mm/s) relative to nominal prediction. Including this Doppler correction in a new orbit estimate and n-body gravitational propagation increases the 2029 April 13.9 Earth-center miss-distance from 5.77 ± 0.39 to 5.86 ± 0.12 Earth radii, reducing the along-track position uncertainty at closest approach from ± 1957 to ± 757 km; the volume of the spatial uncertainty region decreases from 173000 to 39800 km^3. The new Doppler measurement increases the predicted nominal Earth close approach in 2036 from 0.005 to 0.14 AU. However, we have found that computational noise intrinsic to 64-bit representations of real numbers used in arithmetical operations, exacerbated by the close Earth encounter in 2029, can accumulate trajectory-prediction error exceeding the radius of the Earth by 2036. Using more precise 128-bit representations, the specified local error tolerance was reduced from 10^{-14} to 10^{-19} and the maximum predictor/corrector order (used for step-size and error-control decisions) increased from 14/15 to 21/22. This approach reduces error growth in the integration due to the finite representation of real numbers and permits examination of those specific orbit variations in 2036 for which trajectory offsets comparable to the size of the earth are significant."

POSSIBLE NOVA IN SMALL MAGELLANIC CLOUD

J. D. Neill, University of Victoria, and M. C. B. Ashley, University of New South Wales, report the discovery of an apparent nova on unfiltered CCD images taken on Aug. 22.463 (at mag 14.5) and 18.474 UT (mag 14.2) with the 0.45-m ROTSE-III telescope at Siding Spring Observatory in the course of a nova patrol of the Small Magellanic Cloud. The new object is located at $\alpha = 1^{h}15^{m}00^{s}.15$, $\delta = -73^{o}25'38''.1$ (equinox 2000.0), which is ≈ $97'.6$ east and $35'.9$ south of the center of the SMC. The new object is not present on images by Neill and Ashley from July 29, 30, 31, and Aug. 1 (limiting mag 17.5) or on a Palomar Sky Survey plate from 1989 Nov. 20 (limiting red mag ∼ 20.0).

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