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DETECTION OF SMALL IMPACTING ASTEROIDS WITH THE ATLAS TELESCOPE SYSTEM

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ABSTRACT

We simulate the detectability of NEOs with sizes down to 10 meters (absolute magnitude 28) by the NASA-funded Asteroid Terrestrial-impact Last Alert System (ATLAS) survey operating in Hawai'i. Our simulation yields the fraction of all NEOs that ATLAS detects within a given period, as a function of asteroid size. We use this size-dependent detection fraction to scale the number of real NEOs detected by ATLAS into an estimate of the total NEO population, and we find that the number of small NEOs is significantly larger than some recent estimates. We estimate the fraction of close (0.01 AU) approaches to Earth that go completely undetected, and we suggest that all surveys have a strong bias against small asteroids with large encounter velocities. Although we have assumed in our simulation that the orbital distribution of very small NEOs is the same as for their larger counterparts, we note that if in fact the orbital distributions differ in a sense that causes small NEOs to have statistically higher relative velocities during Earth encounters, this bias probably would not be detectable with current data – and would cause additional underestimation of the total number of small NEOs. We describe efforts by the ATLAS survey to correct for this bias, and discuss the imminent improvement in NEO detection capability from the expansion of the ATLAS system with two additional telescopes in the southern hemisphere by late 2020.

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