

Impact Warning Times for Earth Crossing Asteroids

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Of the ~ 100 numbered Earth crossing asteroids (ECAs), none is predicted to impact the Earth within the next 200 years. It is more difficult to make definitive predictions for unnumbered ECAs because their orbits are not accurately known. In addition, a large fraction of the ECA population has yet to be discovered. What would the warning time be for an asteroid on an Earth collision trajectory? The answer depends on how long before impact the object is discovered, and whether or not it has been observed on multiple apparitions. If the asteroid is discovered on its final approach to Earth, the warning time would be short, ranging from a few hours to a few months. If the asteroid is discovered during an apparition earlier than the one on which it will impact, it is generally not possible to say whether impact will occur until further observations are made, either with radar, or optically during a subsequent apparition. The orbit then becomes much better determined, and a definitive impact prediction can be made, even if the impact is decades into the future. To demonstrate these conclusions, a number of simulated cases are used, including the recently discovered Apollo asteroid 1997 BR, its orbit altered slightly so that it impacts Earth in 2051. With the current single apparition of optical astrometric data, the impact probability for this simulated rogue asteroid is about 1%. If the asteroid is observed with radar in July 1997, the probability increases to 20%; if a few optical observations are made in 2000, the impact probability in 2051 increases to 99%.

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