

Mission & Campaign Designs

## Directed Energy for Planetary Defense

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Directed energy (DE) for planetary defense is now a viable option and is superior in many ways to other proposed technologies, being able to defend the Earth against all known threats. We present the underlying physics behind a directed energy planetary defense system that utilizes laser ablation of an asteroid to impart a deflecting force on the target. Two basic variants of the system are long range “stand-off” where the system remains on or near the Earth (ground, orbital, lunar) and short range “stand-on” where a single launcher system is carried to the target. These are referred to as DE-STAR - **Directed Energy System for Targeting of Asteroids and exploration** and **DE-STARLITE** respectively. We show that for the smaller single launcher **DE-STARLITE** stand-on system in a comparison of “per kilogram launched” a DE system is almost always much more effective than kinetic impactors, ion beam deflection and gravity tractors and allow much more control of the final target trajectory than impactors. In addition to deflection of asteroids the larger stand-off systems are extremely effective against comets. In addition to deflection the same system can be used for long range active illumination (LIDAR) to allow detection and orbital determination of smaller asteroids that are difficult to find with reflected or emitted IR surveys as well as being used for remote composition analysis. The same basic design for DE phased array that we use in our NASA directed energy DEEP-IN and DEIS programs, studying the feasibility of the first generation of small relativistic probes for interstellar missions, can also be used for planetary defense with virtually no change allowing for a significant amortization of resources as well as a multi modal program. While the larger “stand-off” systems are being pursued for longer term development the same core technology is available now for single launcher solutions for planetary defense against longer lead time targets including several hundred meter diameter asteroids where the threat is known several years in advance.

Our web resources for further information and technical papers:

DE for Planetary Defense - [www.deepspace.ucsb.edu/DE-STAR](http://www.deepspace.ucsb.edu/DE-STAR)

NASA DE arrays for relativistic missions program - [www.deepspace.ucsb.edu/Interstellar](http://www.deepspace.ucsb.edu/Interstellar)

### Comments:

*We prefer an oral presentation for this abstract.*

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