HA_{F

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Goals

- Perform a simulation of a supernova explosion near the Solar system (at, say, 10 parsecs) using the VH1 hydrodynamics solver.
- Explore the effects of the explosion (in particular, near the orbit of the Earth) and how they vary depending on the energy of the supernova (relative to the force of the Solar wind), proximity, and density.

Motivation



The Solar Wind



Resources and Tools

Advanced Composition Explorer (ACE)



Launched: 1997 Runs out of fuel ≈ 2024

ACE Real Time Solar Wind



near-real-time 24/7 continuous coverage

Previous Work and Simulations

SUPERNOVA COLLISIONS WITH THE HELIOSPHERE BRIAN D. FIELDS, THEMIS ATHANASSIADOU, AND SCOTT R. JOHNSON Center for Theoretical Astrophysics. Departments of Astronomy and Physics, University of Illinois, Urbana, IL 61801; bdfields@uiuc.edu, athanssd@uiuc.edu, srjohns1@uiuc.edu Received 2006 November 22; accepted 2007 September 5

TABLE 1

Adopted Interstellar Medium Parameters for Supernova Simulations

ISM Model	Density, $n_{\rm H}$ (cm ⁻³)	Temperature, T (K)	Pressure, P (dyne cm ⁻²)
Local Interstellar Cloud	0.1	8000	2.2×10^{-13}
Local Bubble	0.005	1.28×10^{6}	1.8×10^{-12}
Average ISM	1.0	8000	2.2×10^{-12}

Simulation: FLASH Blast Properties: SN at 10 pc Geometry: Cylindrical



Results

Sedov Blast in 1D

- Simulate supernova explosion

 E = 10⁵¹ erg
- Extract blast properties at 10 parsecs from earth



Sedov Blast in 1D

- Simulate supernova explosion

 E = 10⁵¹ erg
- Extract blast properties at 10 parsecs from earth



Simulate Solar Wind with Realistic Parameters in 2D

SNE: \circ ~10⁵¹ erg • 0.4 /cm³ • varied: 950 km/s (shown here) 1900 km/s 5700 km/s Solar wind: \circ 6 / cm³ 470 km/s



Conclusions