Computational models of asteroid airbursts on Earth are rooted in simulations of the 1994 impact of Comet Shoemaker-Levy 9 on Jupiter. The 1908 Tunguska explosion in Siberia is the best-known example. Models suggest that the altitude of maximum energy deposition is not a good estimate of the equivalent height of a point explosion. The 2013 Chelyabinsk event yielded direct observational data that could be compared to models, confirming this conclusion. The center of mass of an exploding projectile maintains a significant fraction of its initial momentum and is transported downward and forward. The fireball—a hot jet of ablated asteroid—descends to a depth well beneath the burst altitude before its velocity becomes subsonic. Stronger blast waves and thermal radiation pulses are therefore experienced at the surface than for an equivalent nuclear explosion. In the Tunguska case, the jet lost its momentum before making contact with the Earth's surface. For impacts above some energy threshold, the fireball reaches the ground, expands radially, and drives supersonic hot winds that can melt surface materials. The Libyan Desert Glass event (~29 million years ago) may be an example of this second, larger and more destructive type of airburst. Recent research has suggested that such airbursts can generate tsunami waves, but the efficiency of this coupling remains controversial. Better understanding of airbursts, combined with the diminishing number of undiscovered large asteroids, leads to the conclusion that airbursts represent a large and growing fraction of the total impact threat. The most effective policies to reduce the impact threat would therefore be to raise awareness of tsunami risk even in seismically inactive ocean basins, and to resurrect the old cold-war “duck-and-cover” concept to minimize casualties from air blast effects.

Explosions in the Sky: Modeling Asteroid Airbursts

Friday March 23, 2018
4:00-5:00
OPS, Room 140

Light Refreshments to be served