Space Breakup Events Modeling and Analysis

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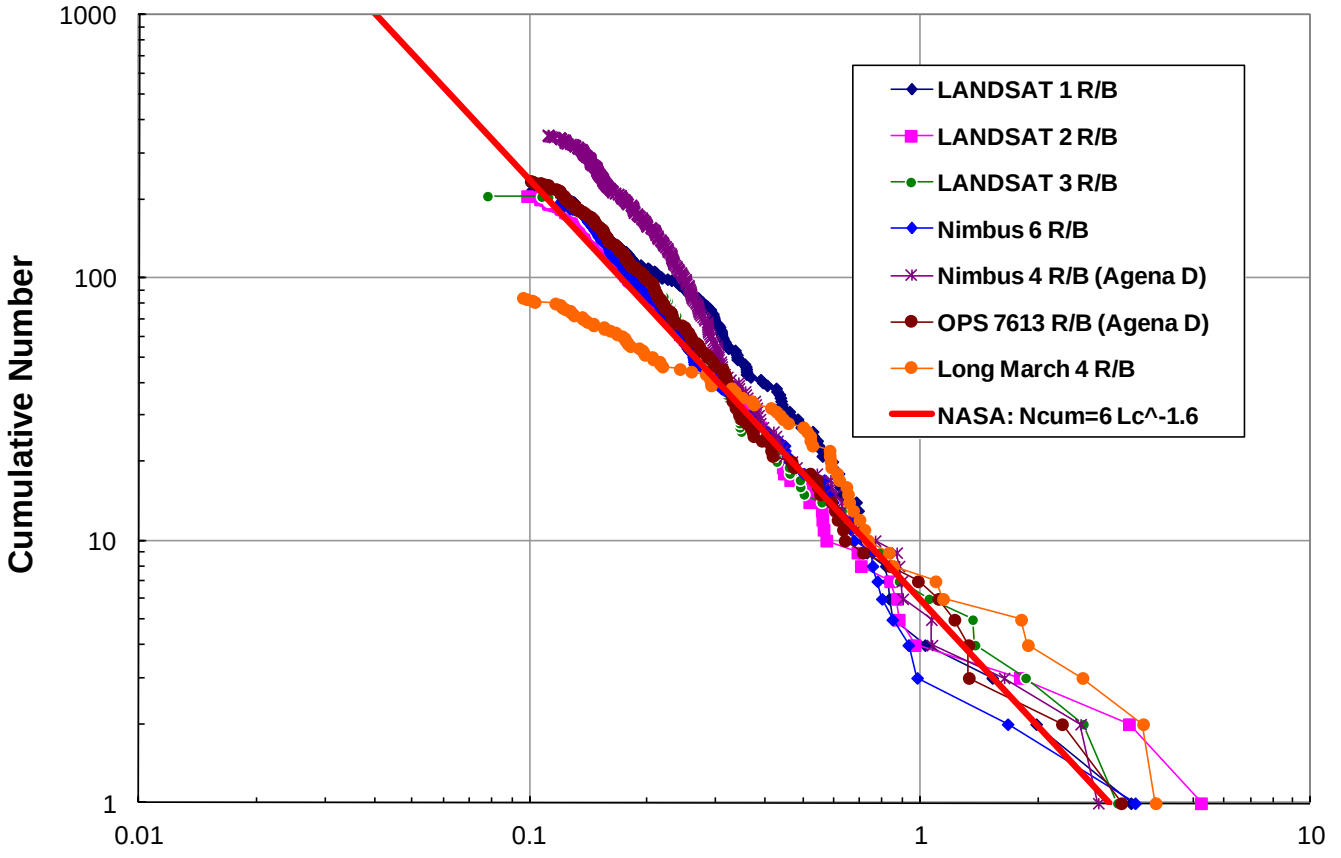
NASA Breakup Model for Explosions

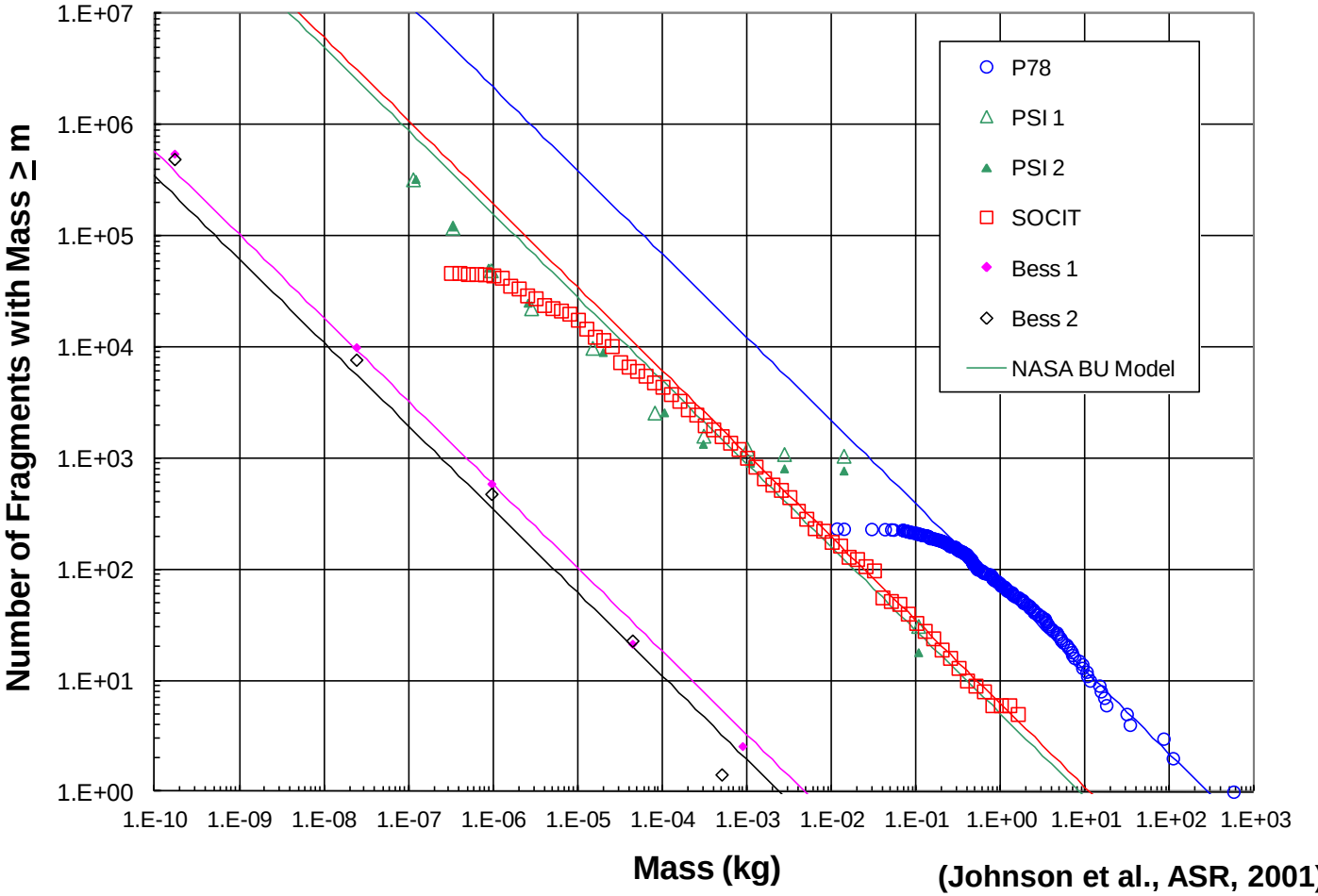
- **The model is based on well-observed on-orbit explosions of launch vehicle upper stages**



(Johnson et al., ASR, 2001)

NASA Breakup Model for Collisions

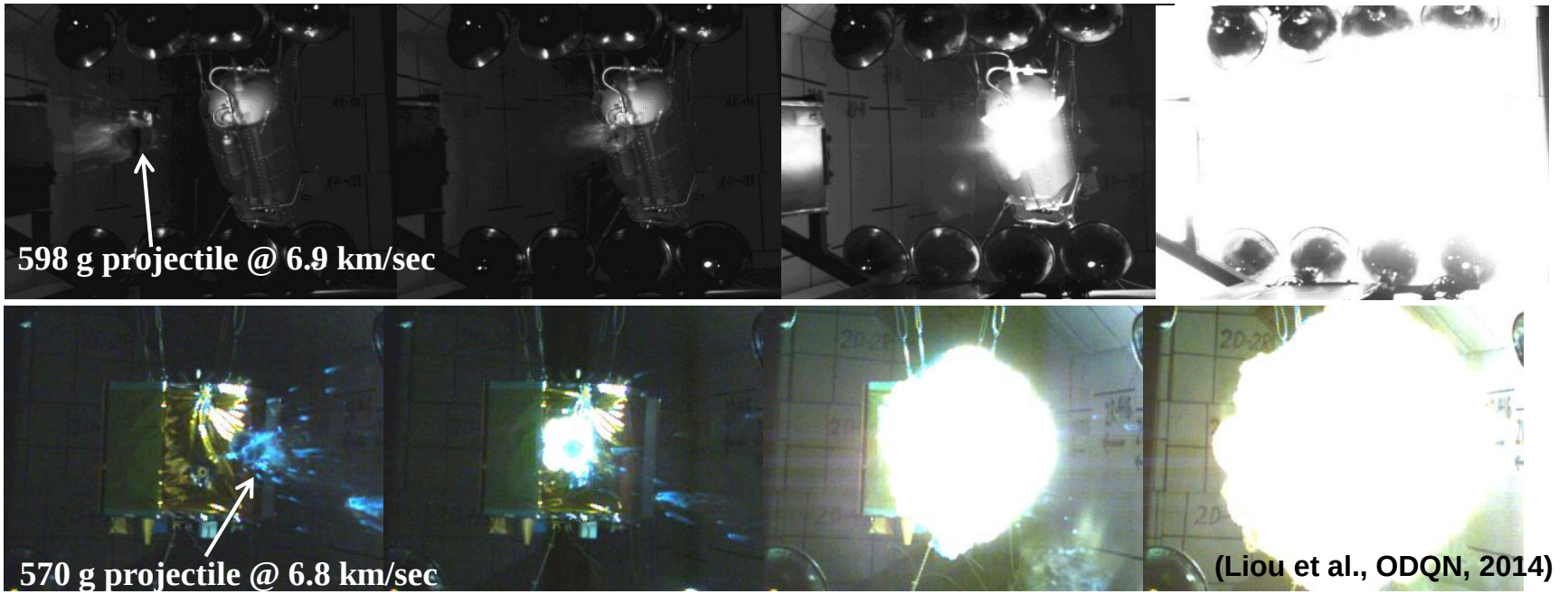
- **The model is based on limited on-orbit data and laboratory-based impact experiments**



(Johnson et al., ASR, 2001)

New Laboratory Impact Experiments

- **To better understand the outcome of an on-orbit collision, such as the accidental collision between Iridium 33 and Cosmos 2251 in 2009, NASA is leading a US-based consortium on new laboratory impact experiments**
  - The goal is to collect new data to improve the satellite breakup model



(Liou et al., ODQN, 2014)

Applications of Satellite Breakup Model

- **The NASA Satellite Breakup Model is used by the international space community to support various applications**
  - Space Situational Awareness
  - Short- and long-term OD impact risks from a new breakup event to critical space assets, including the International Space Station
  - Short- and long-term effects from major breakup events to the OD population increase in the environment