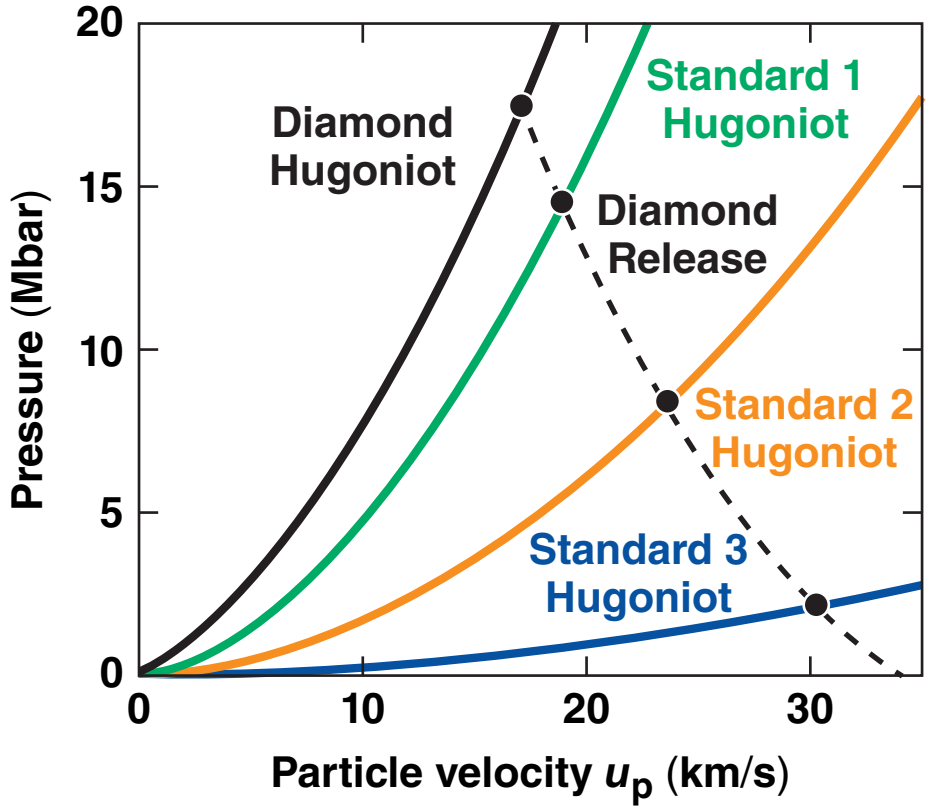
The Release Behavior of Diamond Shocked to 15 Mbar



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Division of Plasma Physics
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Summary

The release of shocked diamond is studied by impedance matching with known standards

UR LLE

- The National Ignition Facility (NIF) uses ultra-nanocrystalline high-density carbon (HDC) ablators
- Knowledge of the diamond release behavior is critical for inertial confinement fusion (ICF) target designs
- Release data are obtained by impedance matching with known standards
- Release models for both single-crystal (SC) diamond and HDC will be constrained by the experimental data

Collaborators

T. R. Boehly, C. A. McCoy, D. N. Polsin, and D. D. Meyerhofer

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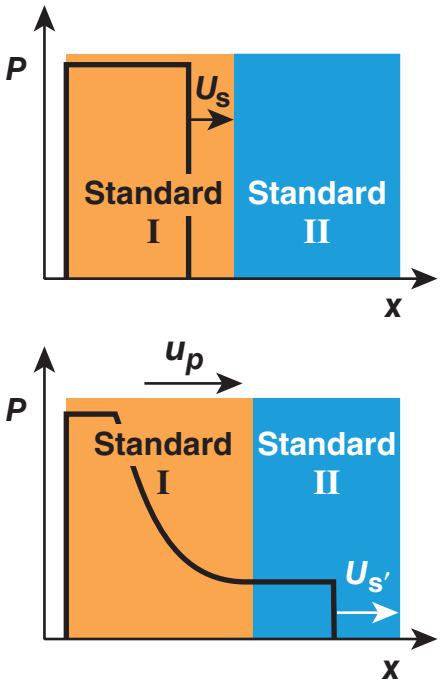
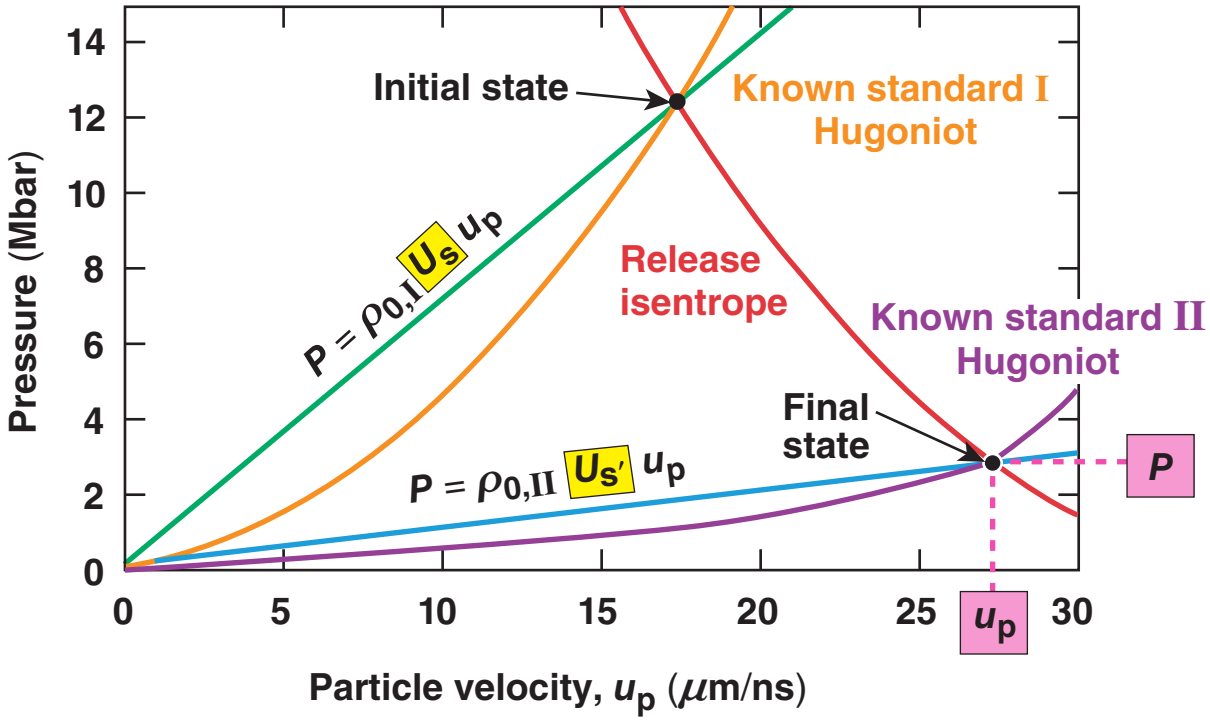
Release data are obtained using the impedance-matching technique between known standards





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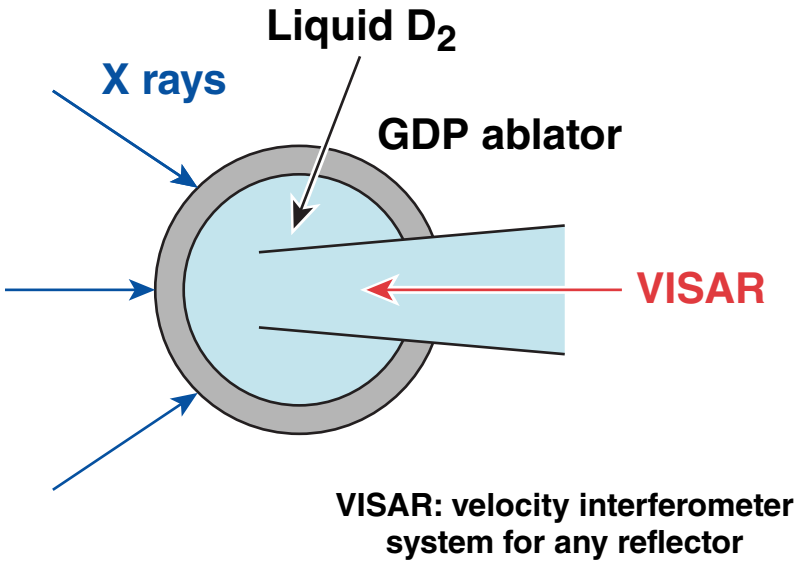
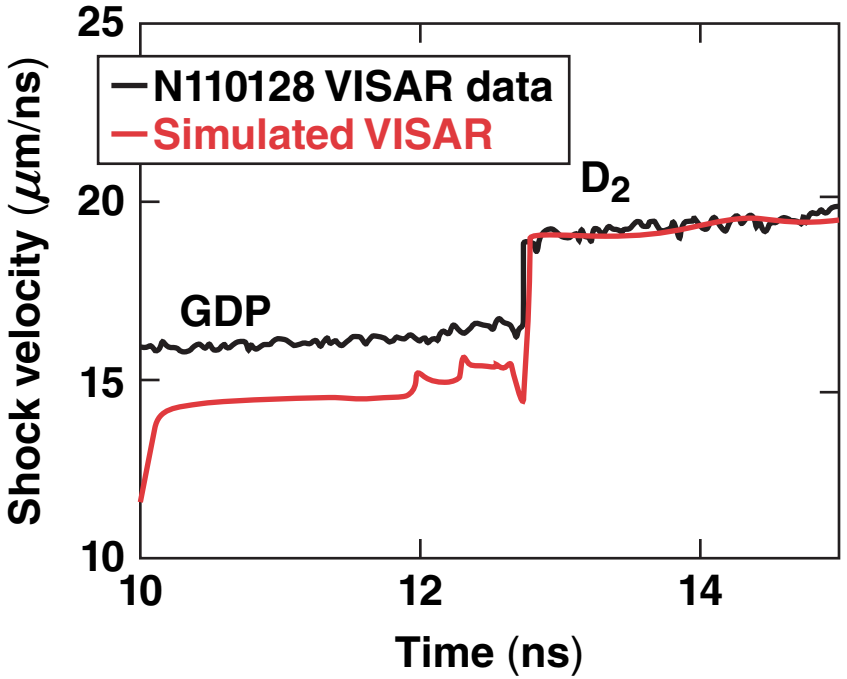
Motivation

Initial NIF shock-timing experiments revealed inaccuracies in the ablator release model



VISAR: velocity interferometer system for any reflector



The glow-discharge polymer (GDP) equation-of-state model was corrected using release data into liquid D_2.*

*S. Hamel *et al.*, Phys. Rev. B 86, 094113 (2012).

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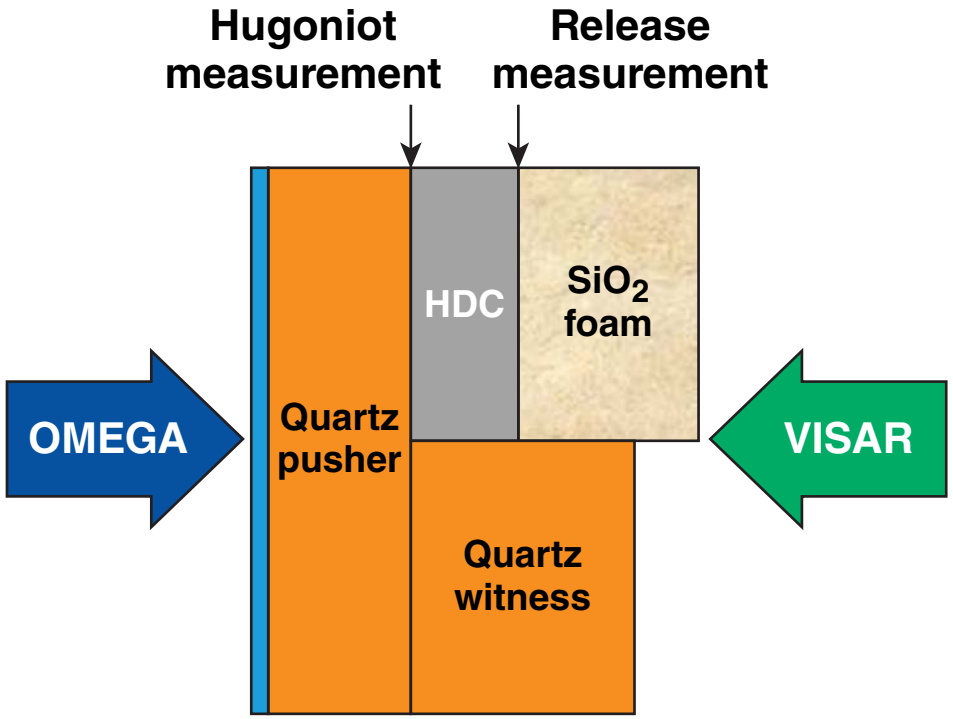
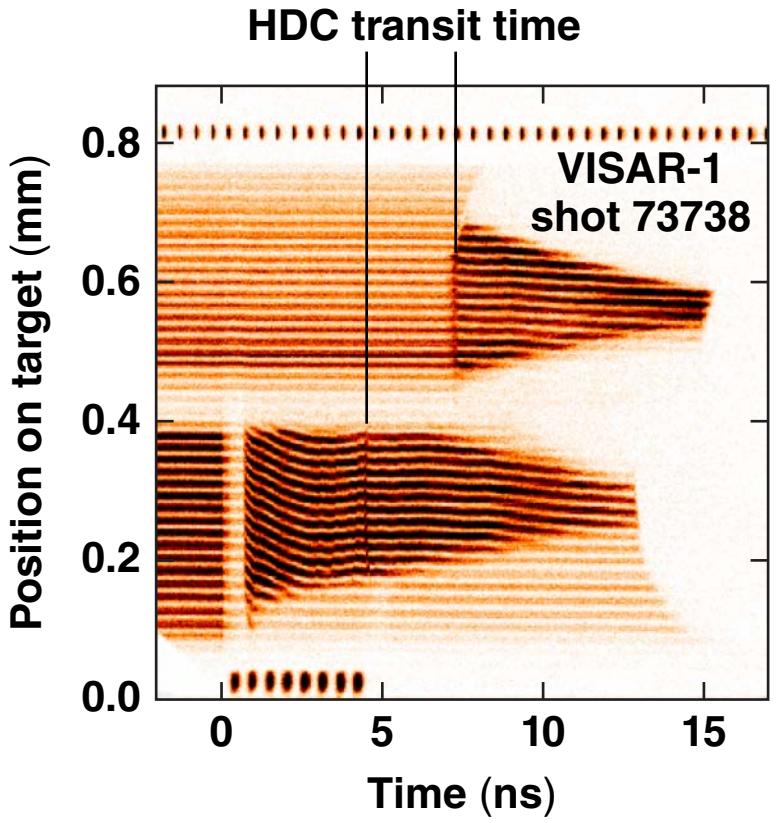
Experiments with HDC provide both Hugoniot and release measurements





- Instantaneous shock velocities in HDC are determined using an unsteady waves correction*

C. A. McCoy *et al.*, CO3.00006, this conference;
D. E. Fratanduono *et al.*, JO7.00008, this conference.
*D. E. Fratanduono *et al.*, J. Appl. Phys. 116, 033517 (2014).

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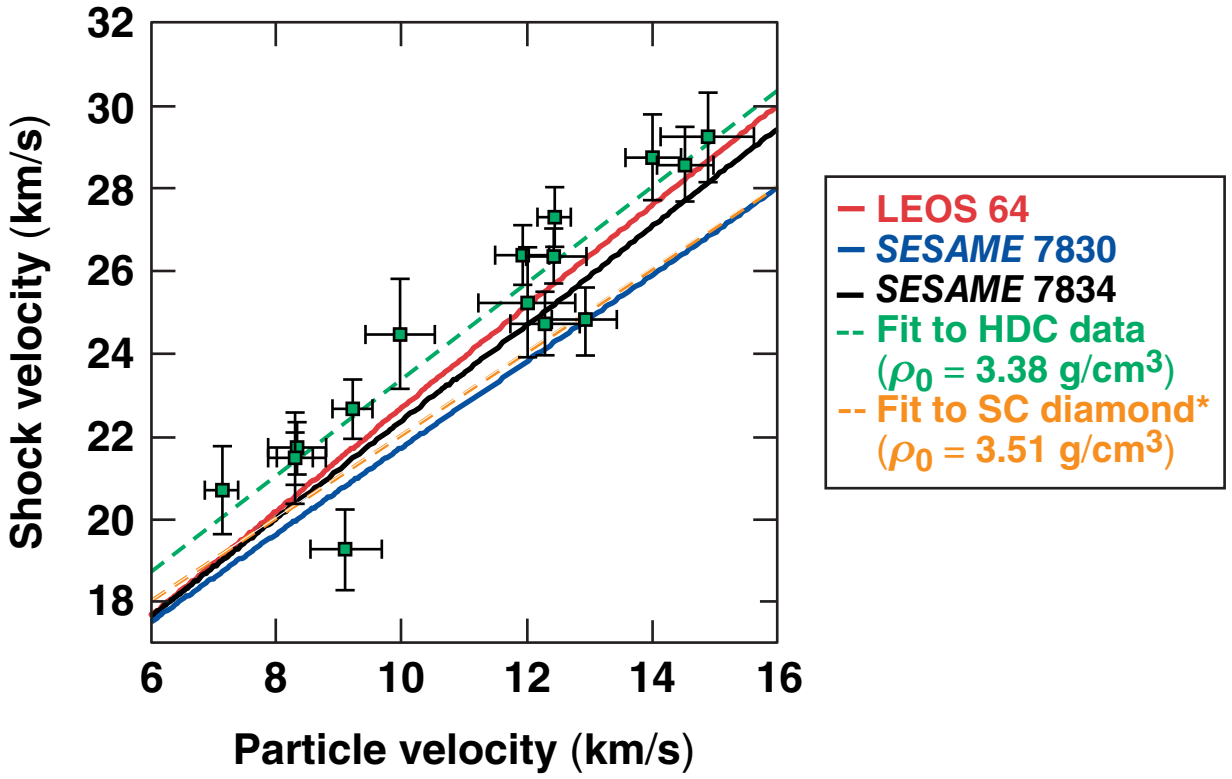
Hugoniot measurements were used to create a U_s–u_p relation for HDC



*D. G. Hicks *et al.*, Phys. Rev. B 78, 174102 (2008).

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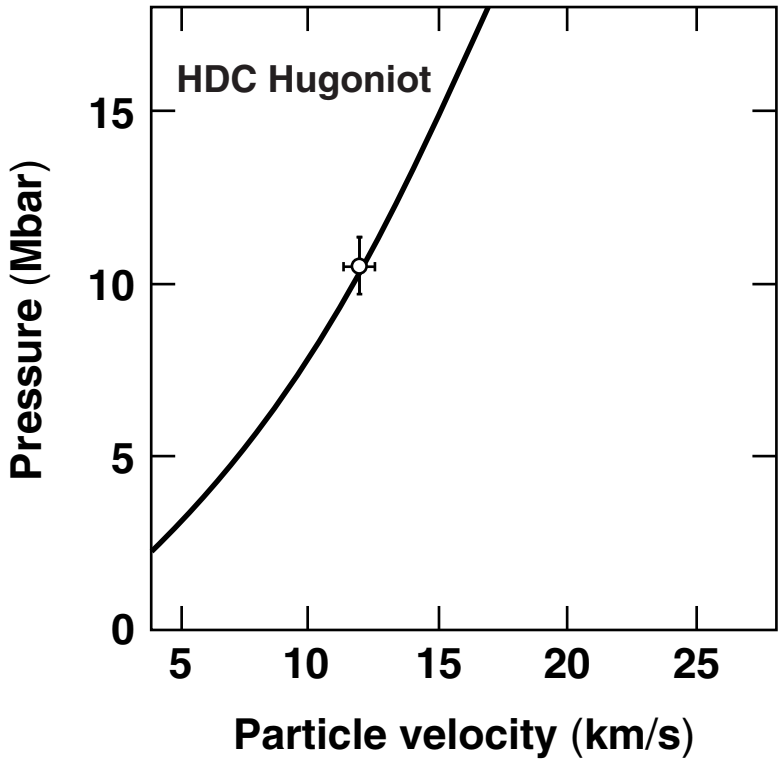
The HDC release model is constrained by the experimental data



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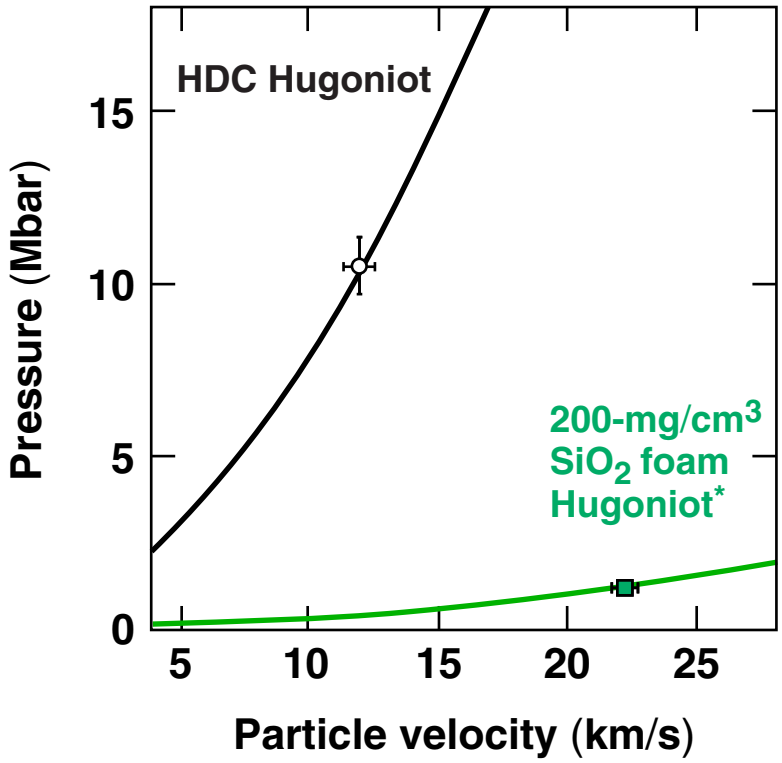
The HDC release model is constrained by the experimental data



*M. D. Knudson and R. W. Lemke, J. Appl. Phys. 114, 053510 (2013).

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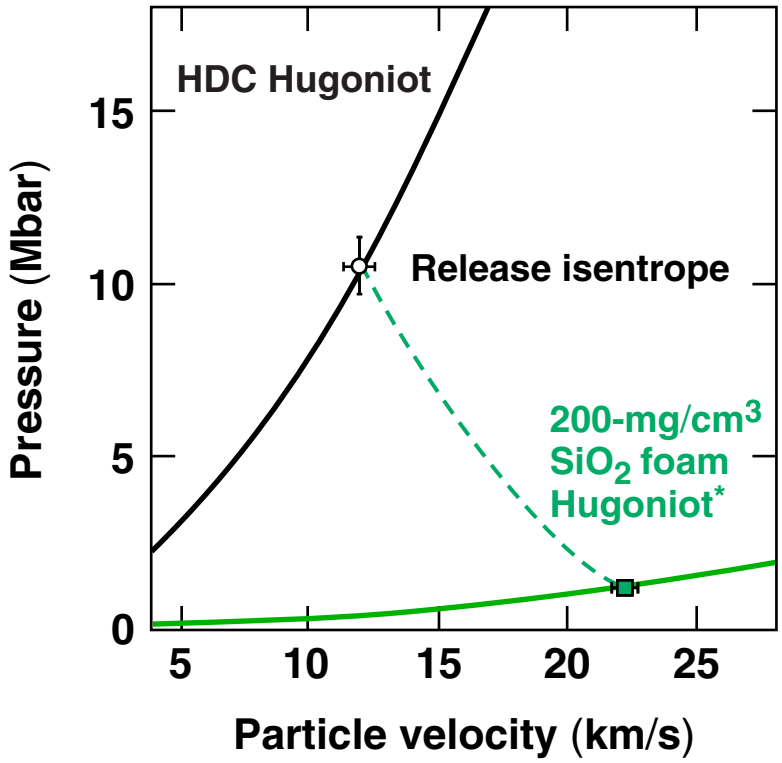
The HDC release model is constrained by the experimental data



*M. D. Knudson and R. W. Lemke, J. Appl. Phys. 114, 053510 (2013).

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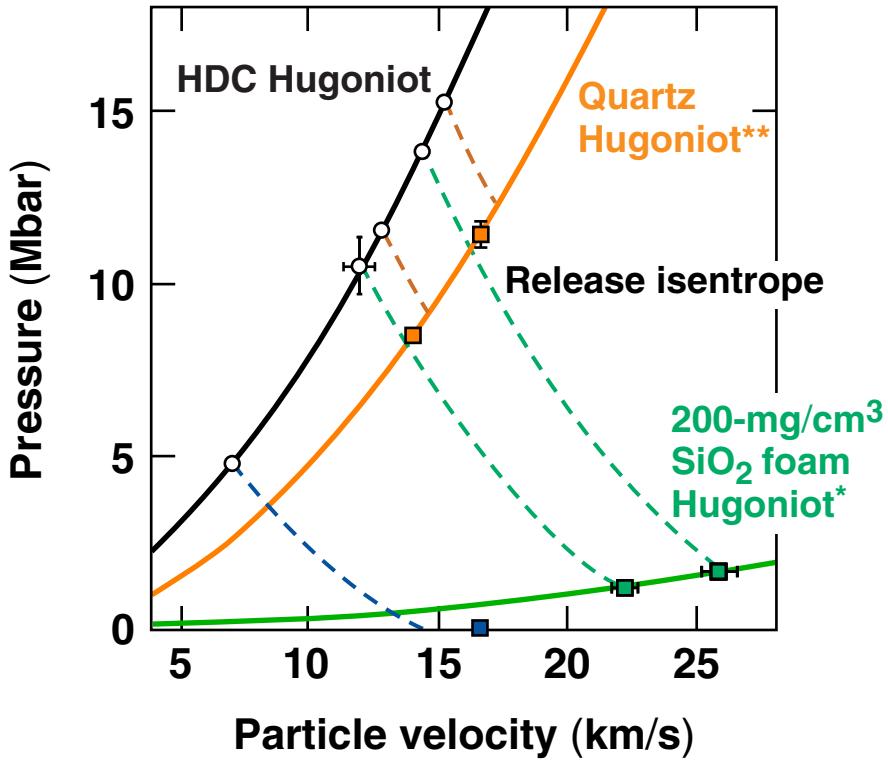

*M. D. Knudson and R. W. Lemke, J. Appl. Phys. 114, 053510 (2013).
**M. D. Knudson and M. P. Desjarlais, Phys. Rev. B 88, 184107 (2013).

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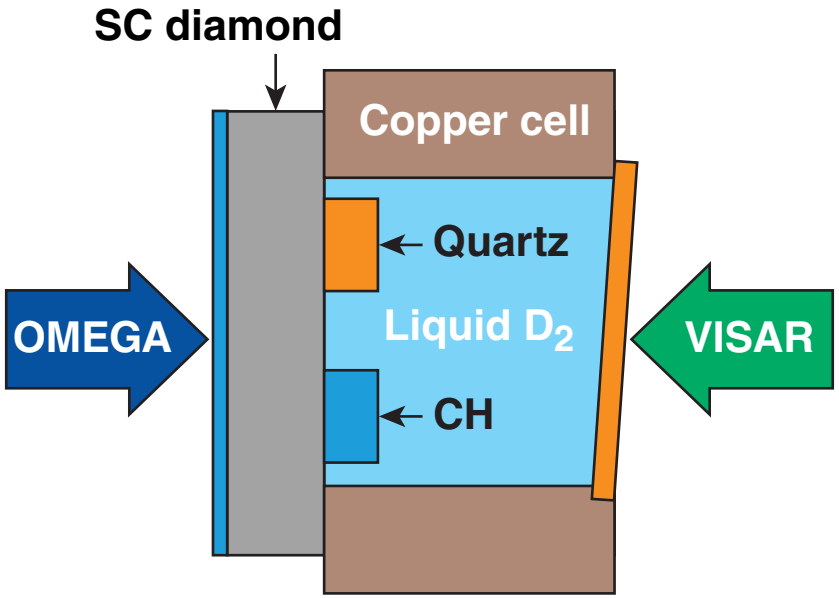
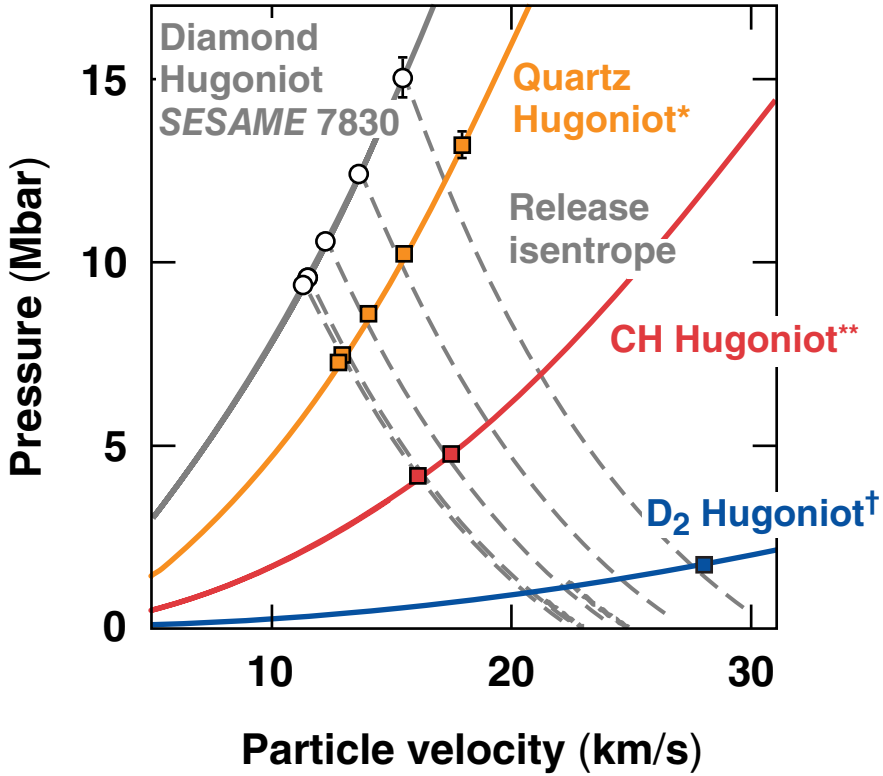
The SC diamond release model is constrained using multiple standards





*M. D. Knudson and M. P. Desjarlais, Phys. Rev. B 88, 184107 (2013).
**M. A. Barrios *et al.*, Phys. Plasmas 17, 056307 (2010).
†D. G. Hicks *et al.*, Phys. Rev. B 79, 014112 (2009).

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Summary/Conclusions

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