Summary of HEDLA-2012

The 9th International Conference on High Energy Density Laboratory Astrophysics
April 30 – May 4, 2012, Tallahassee, FL

Bruce A. Remington
ICF/HED Program
Lawrence Livermore National Laboratory

Where did we stand after the 1st HEDLA (1996)?

1st HEDLA, Pleasanton, CA, 1996

Summary from HEDLA-1996

Discussion:
All major lasers in world represented here ...

- Better diagnostics (Hydro at high compression) (D. Arnett) to observe the details in mix
- Collisionless shocks (E. Waxman)
- Relativistic shocks "
- Relativistic plasmas
- Particle distributions (J. Raymond)
- $T_i > T_e \rightarrow T_i = T_e$ (R. McCray)
- Rad. hydro, MHD, Rad. MHD (J. Stone)
- Open data sets, calculations to community (N. Zabusky)

↳ Code validation group, effort (like the opacity effort)

LANL preprint server

email list of attendees to everyone

electron heat transport

magnetic field (self) generation

strongly coupled plasmas ← EOS of H, He, ...; insul.→metal
Lattice dynamics; 1D→3D; $\nu_{lattice}$
Material properties: T_m, $\gamma_{(P)}$, $G_{(P)}$

thermal condensation instability

Burn physics

The conclusion from HEDLA-1996

- The conclusion of the meeting was a consensus that there are areas where careful HED laboratory experiments could serve as an astrophysical testing ground, a setting where emerging theories can have a "dry run".

- The challenge is to match the right astrophysics questions with the right HED experiment.

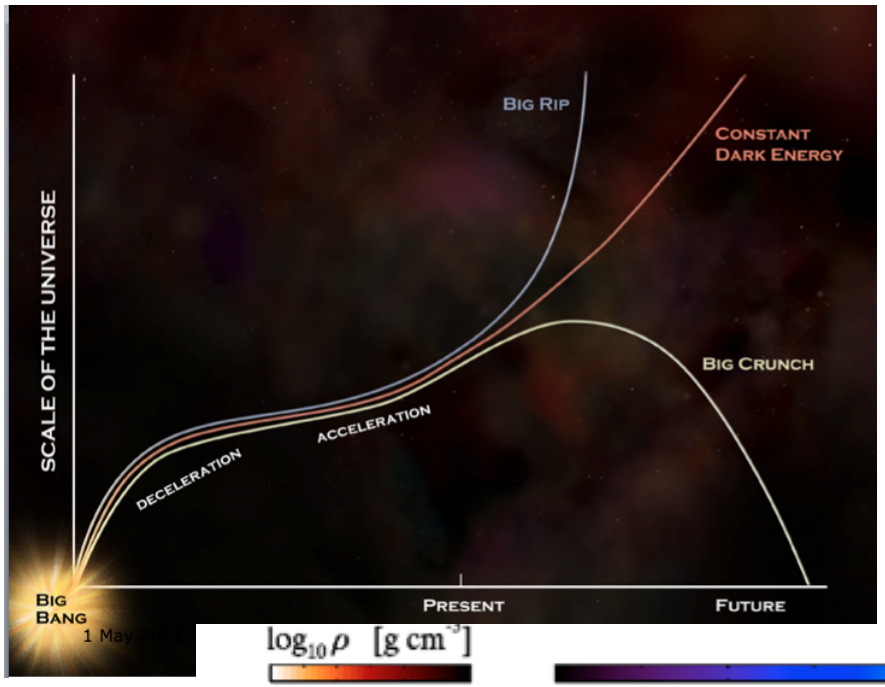
- We hope that the outcome of this workshop will be the start of a continuing dialog between the astrophysics and HED experimental communities, which will lead to more discriminating astrophysics experiments on HED experimental facilities around the world.

- Where do we stand now, 16 yrs later, after the 9^{th} HEDLA-2012?

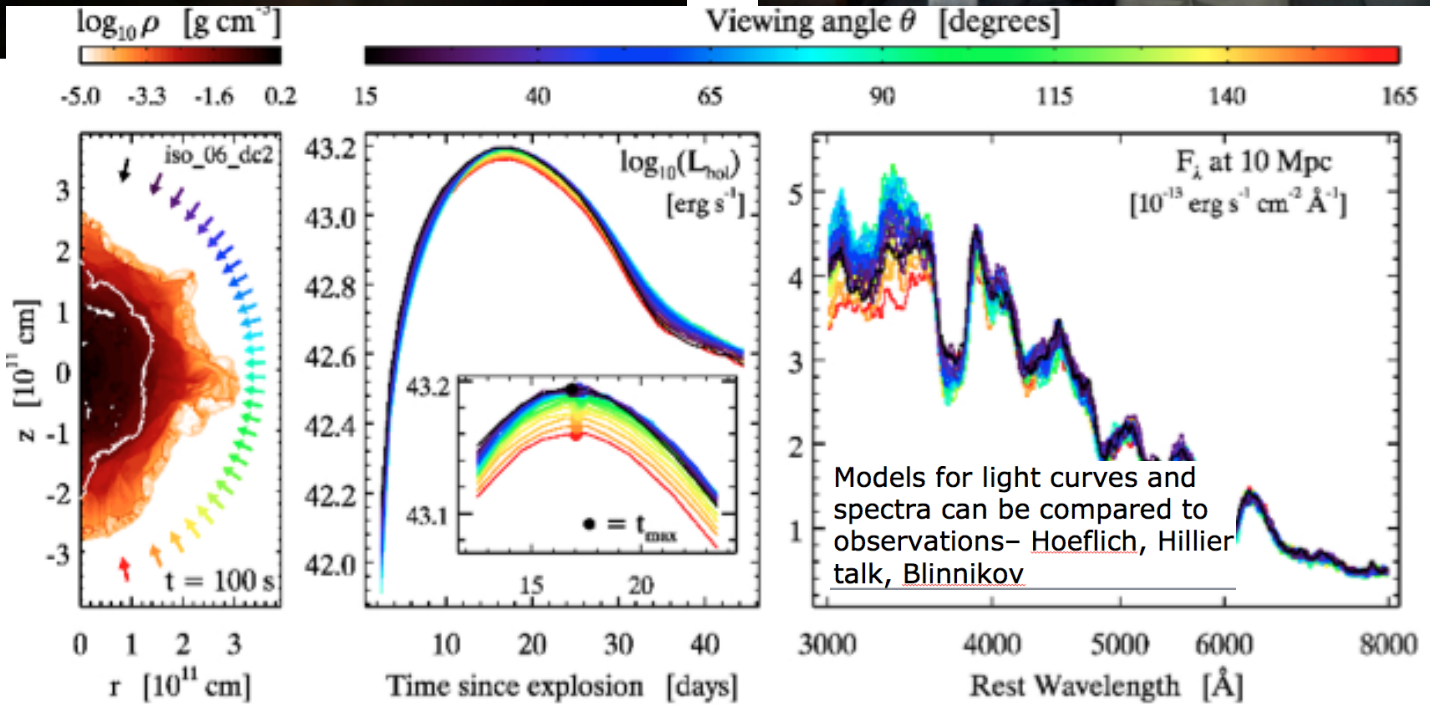
-I'll show just a few highlights

Highlights

Bob Kirshner



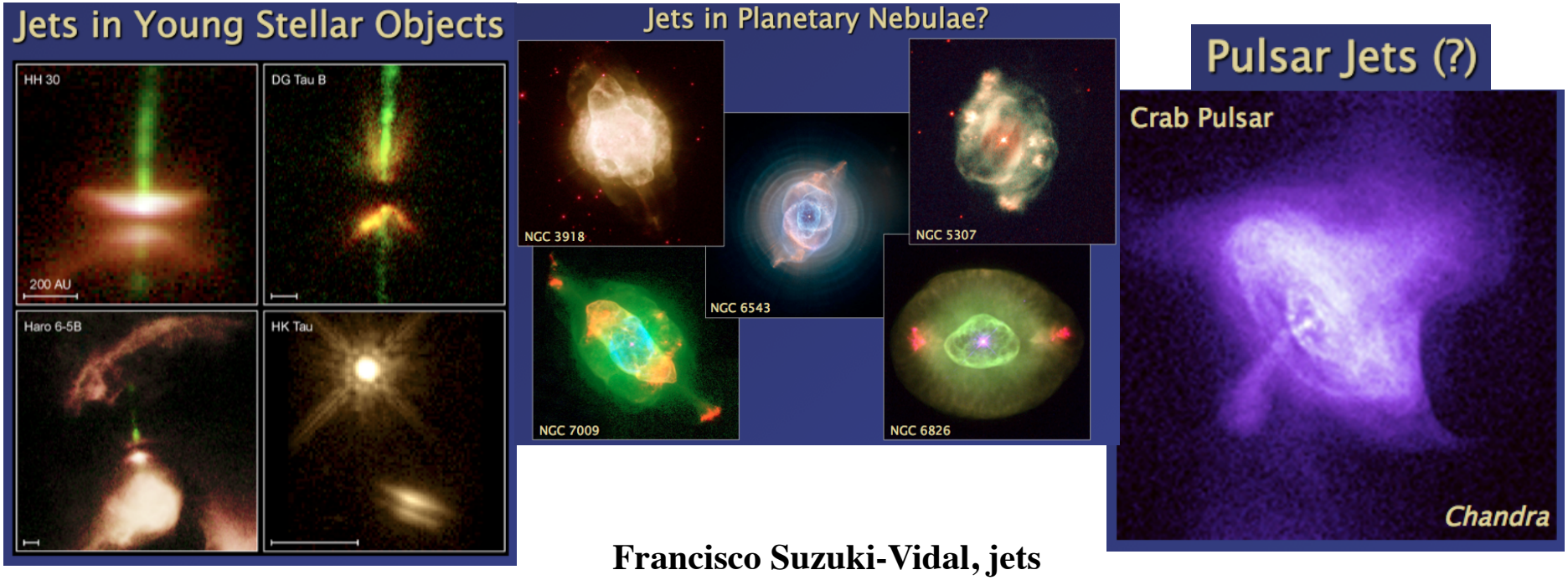
Nobel prize to his former students



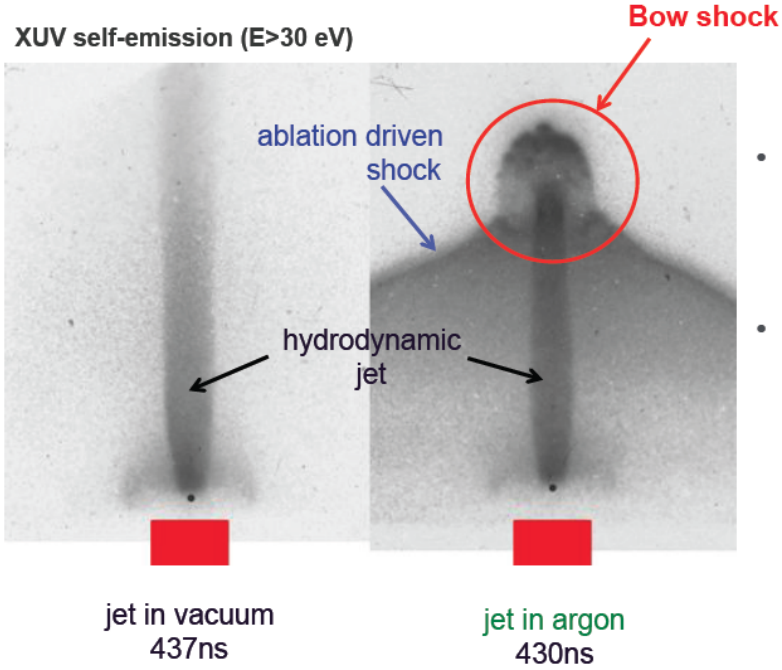
Models for light curves and spectra can be compared to observations– Hoeflich, Hillier talk, Blinnikov

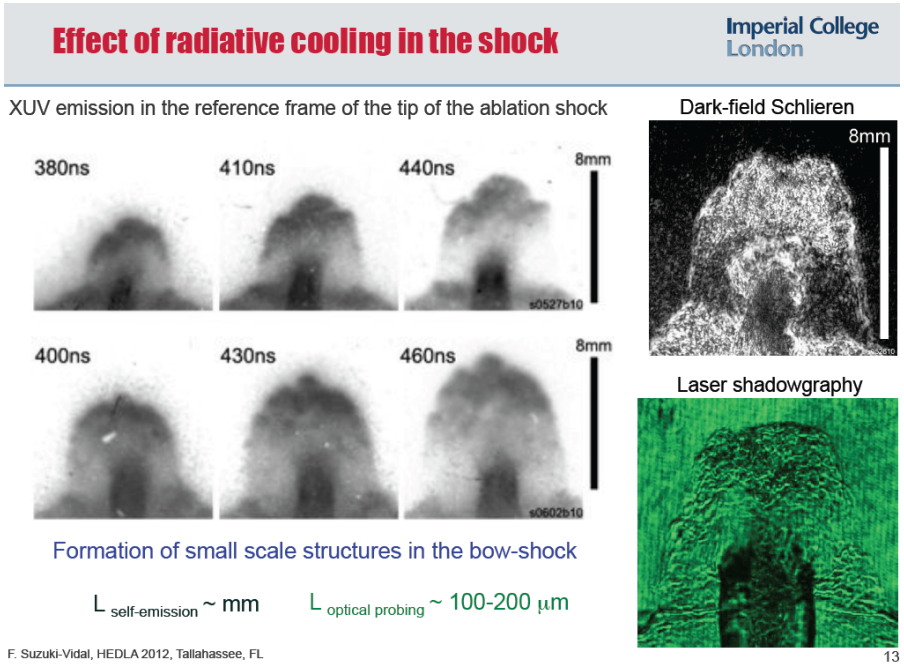
Highlights

Mario Livio, jets to music



Francisco Suzuki-Vidal, jets

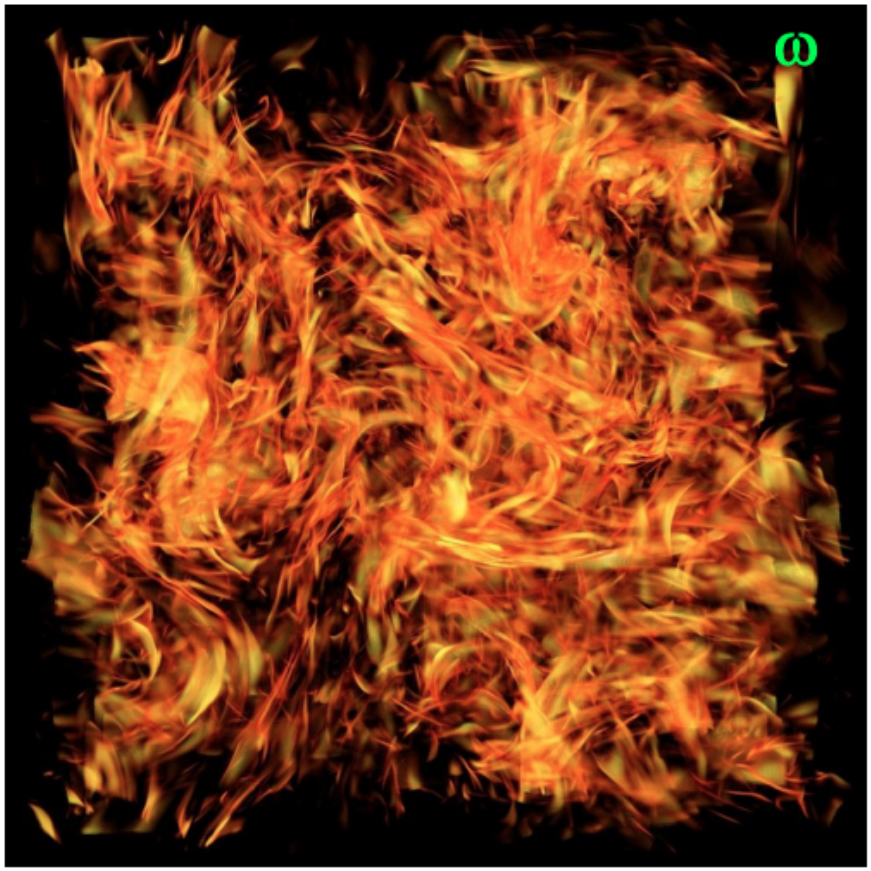


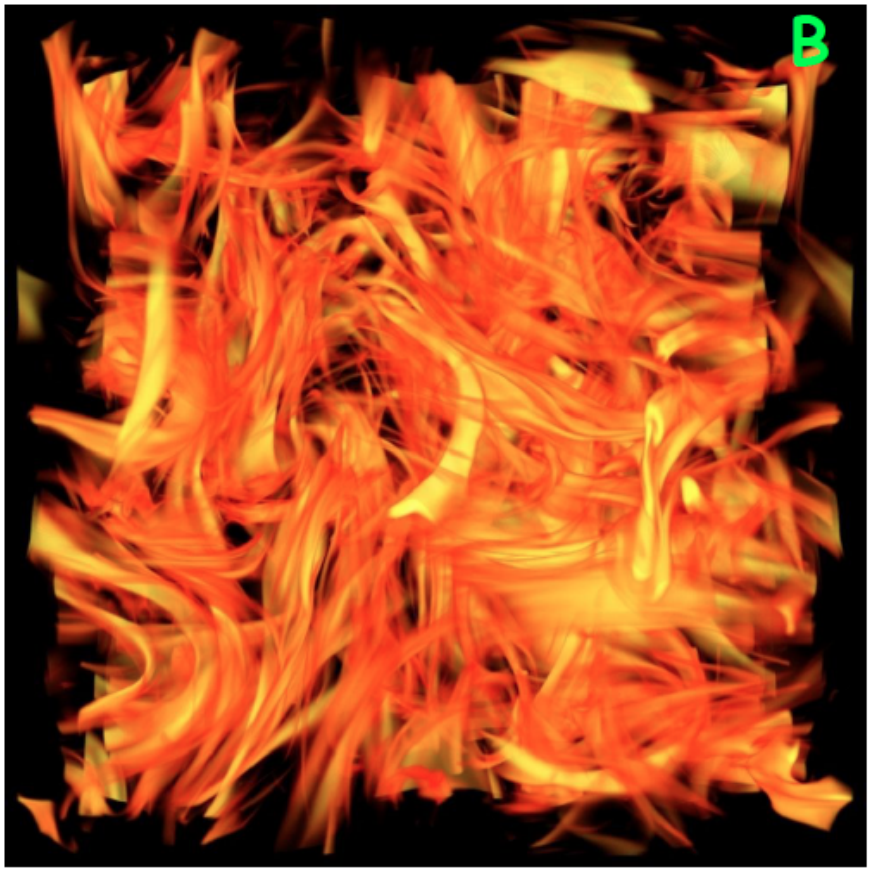


Highlights

Dongsu Ryu, intracluster (intergalactic) turbulence

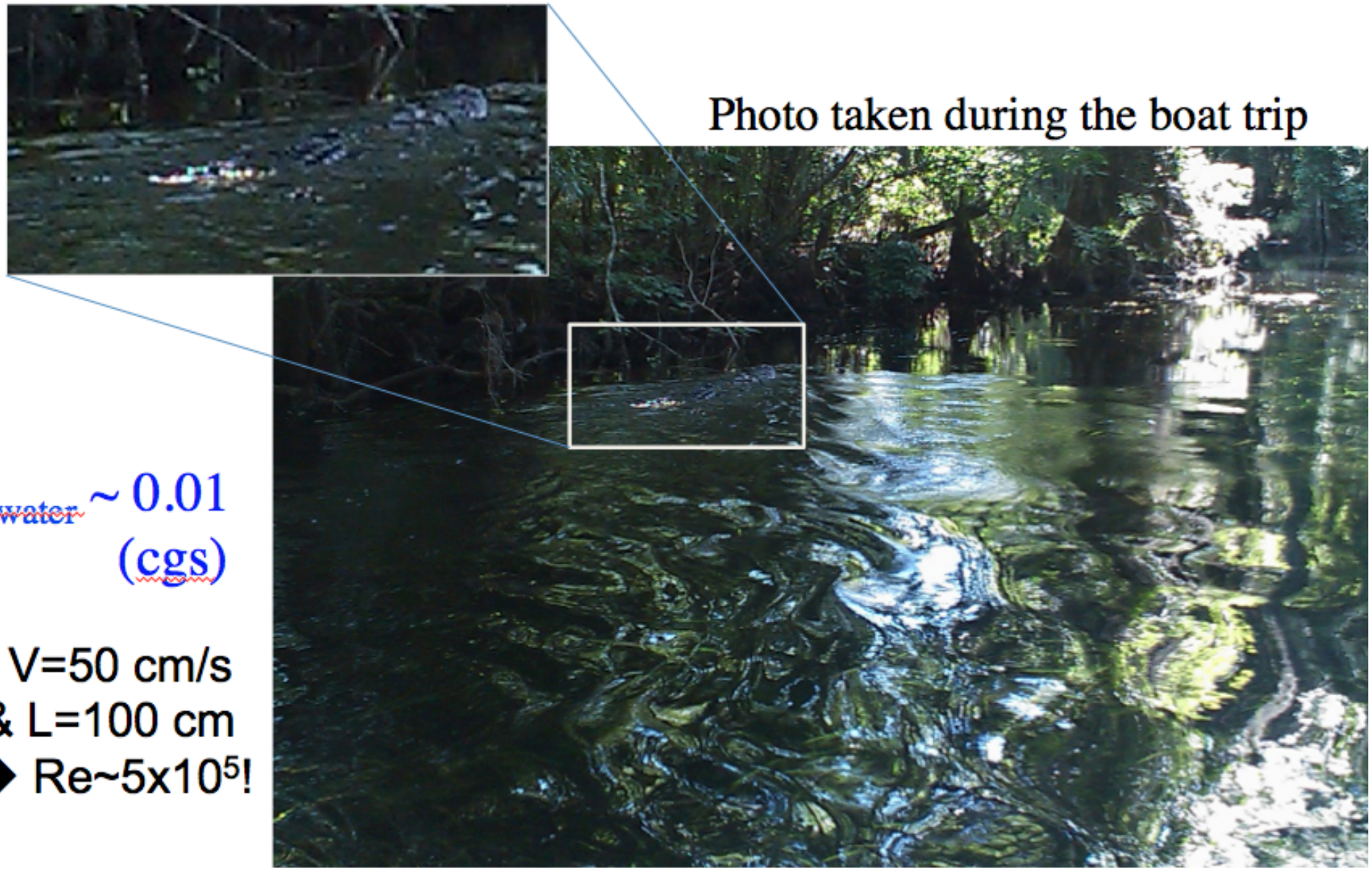
A Simulation Study of Intracluster Turbulence





Dongsu Ryu (Chungnam National U, Korea)

Example of turbulence: Turbulence created by an alligator

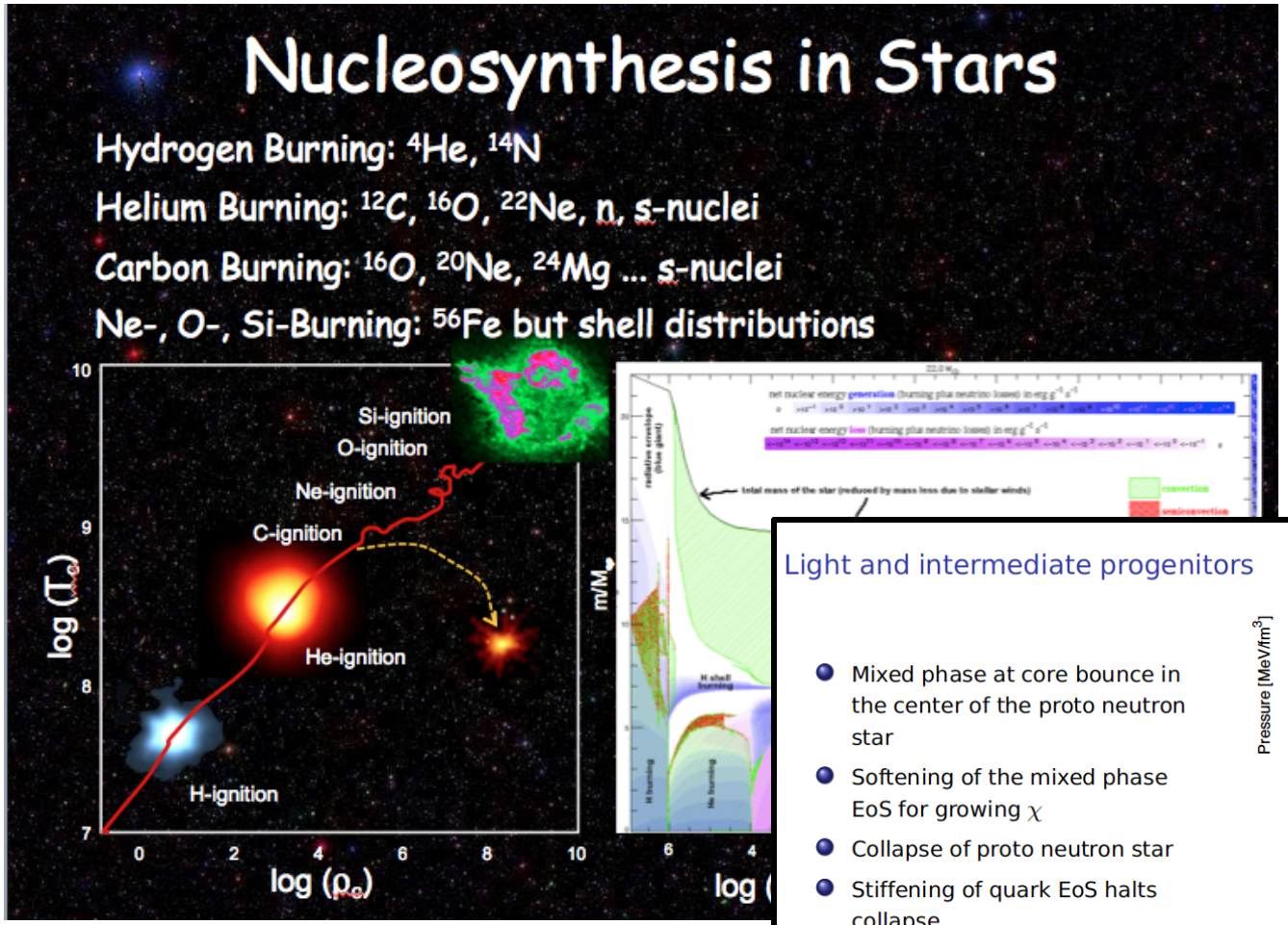


$\nu_{water} \sim 0.01$ (cgs)

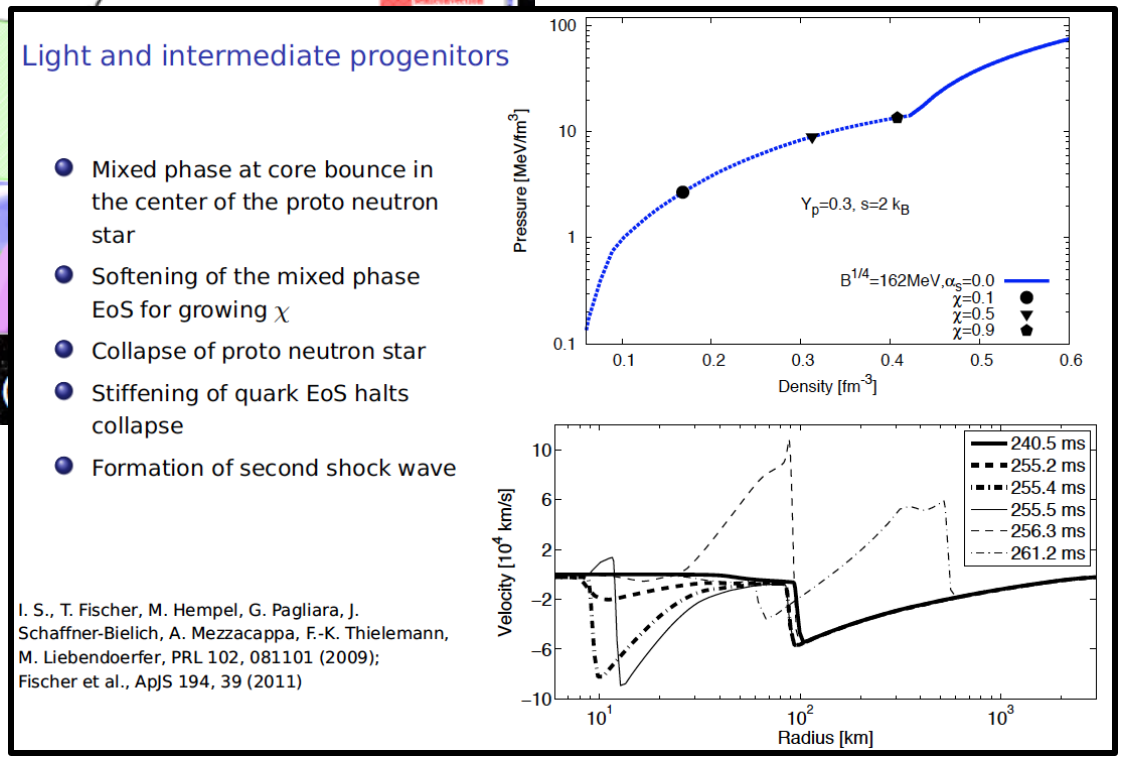
V=50 cm/s
& L=100 cm
➔ Re~5×10^5!

Highlights

Michael Wiescher: nucleosynthesis

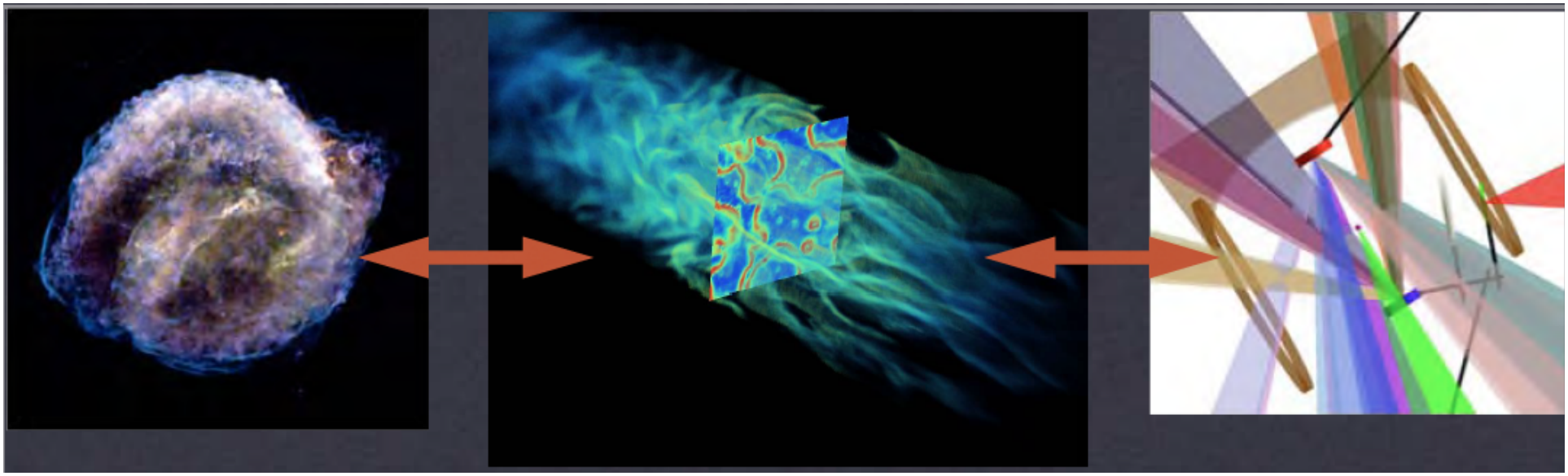


Irina Sagert: hadron-quark phase transition, nuclear EOS



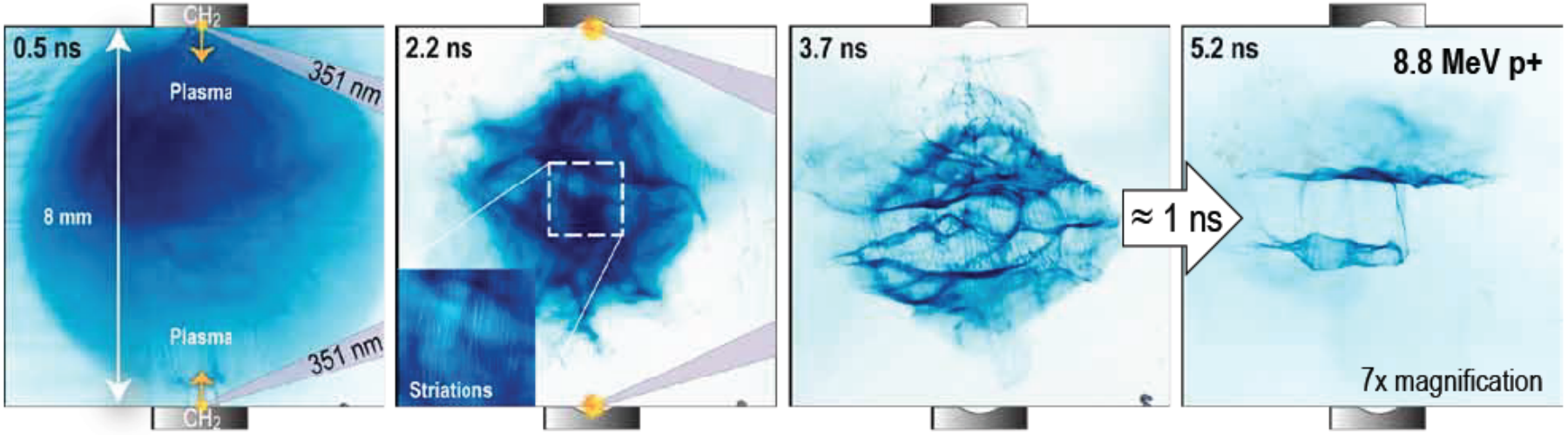
Highlights

Anatoly Spitkovsky, and the ACSEL collaboration



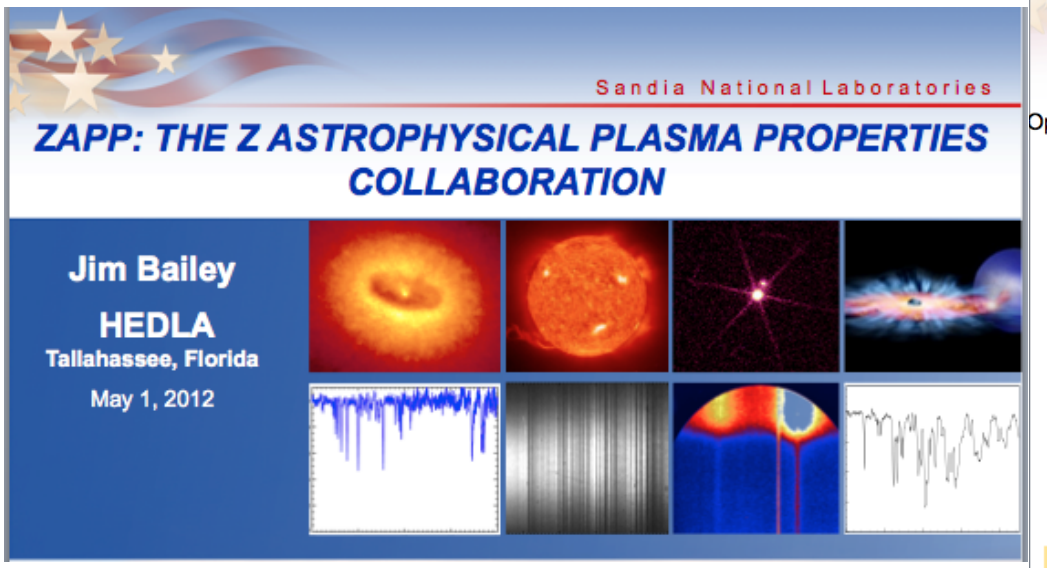
Nathan Kugland, Hye-Sook Park, and the ACSEL collaboration

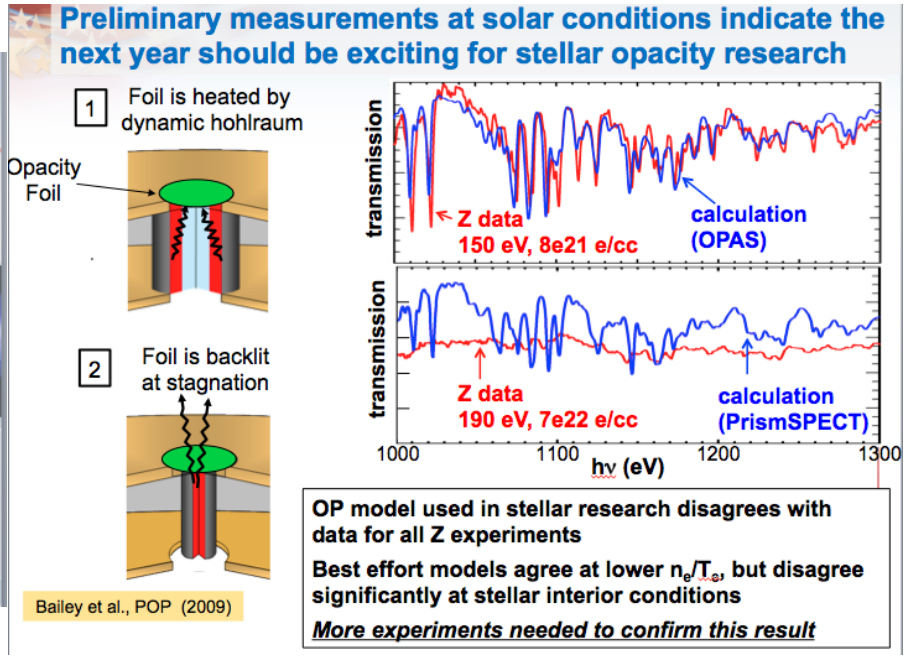
OMEGA EP laser ablation: 2.2 kJ in 3 ns
Proton images (0.2 ns "gating", multi-shot sequence)



Highlights

Jim Bailey, opacities



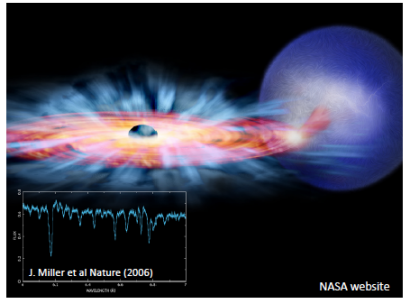


Roberto Mancini, photoionized plasmas

- Widespread in space – active galactic nuclei, accretion discs around black holes
- Plasma is driven by an intense source of X-rays
- Unlike collisional plasmas, photo-ionisation and photo-excitation dominate atomic kinetics
- The complexity of the astrophysical environment makes the spectral analysis challenging ⟶ laboratory experiments are important[1]

Relevance to astrophysics

- Perform well-characterized laboratory photoionized plasma experiments to benchmark modeling codes developed only from theory
- Address specific problems: e.g. effect of resonant Auger destruction on radiative properties of accreting disks

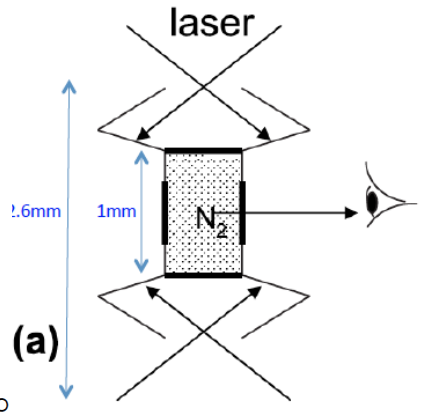


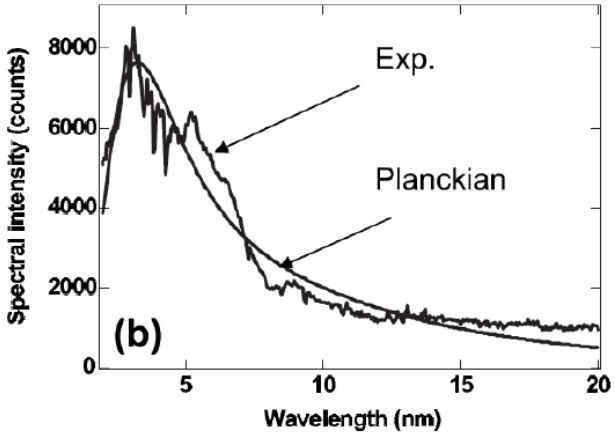
Artists impression of binary system GRO J1655-40, 11,000 lights years away in scorpius constellation

1. R. C. Mancini et al, Phys. Plasmas **16**, 041001 (2009)

Fei-lu Wang et al, PoP **15**, 073108 (2008): experiment concept

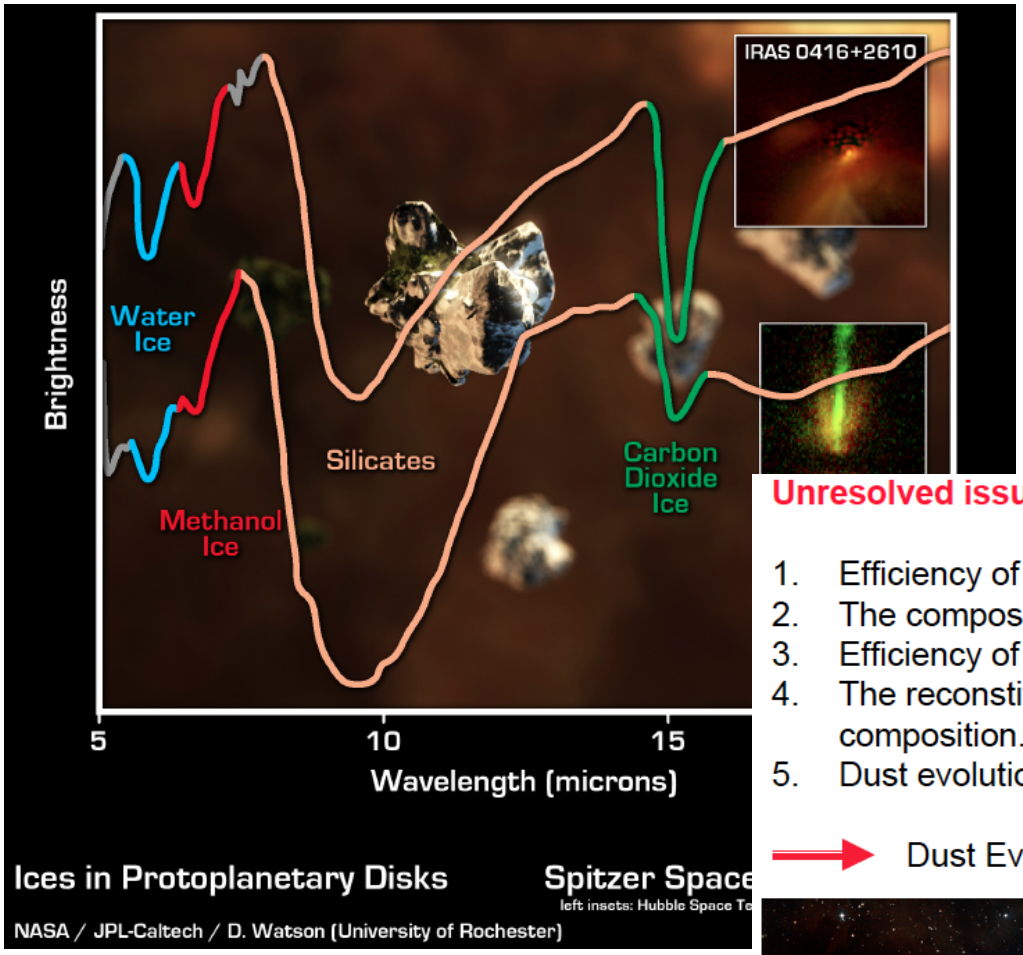
"Dog-bone" hohlraum cavity T_r = 80eV





Highlights

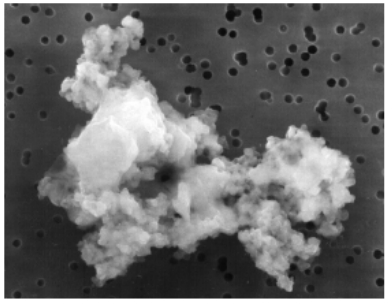
Farid Salama, dust



Unresolved issues:

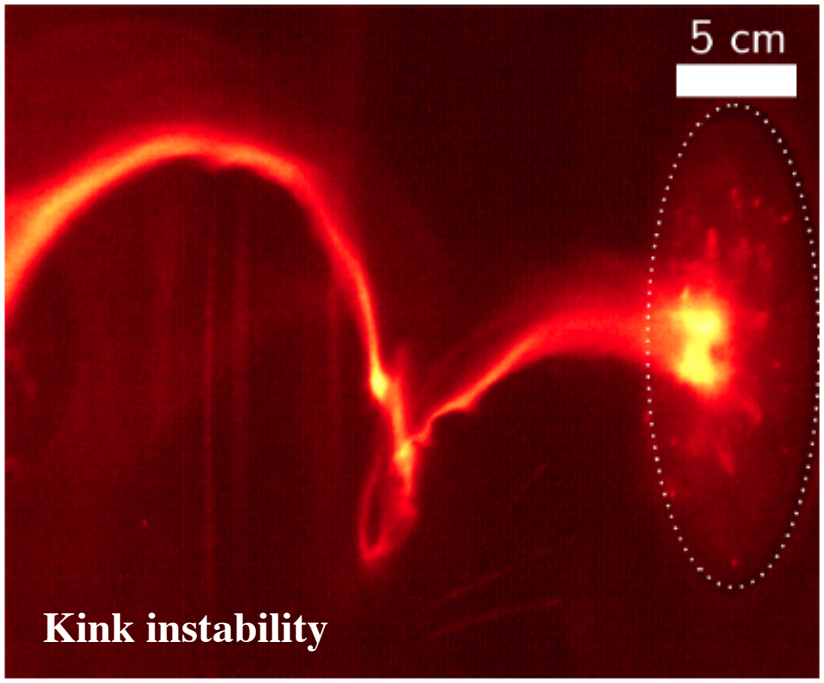
1. Efficiency of dust formation in various sources, especially in supernovae
2. The composition and survival of the newly formed dust
3. Efficiency of dust destruction
4. The reconstitution of dust particles by accretion and the resulting dust composition.
5. Dust evolution .

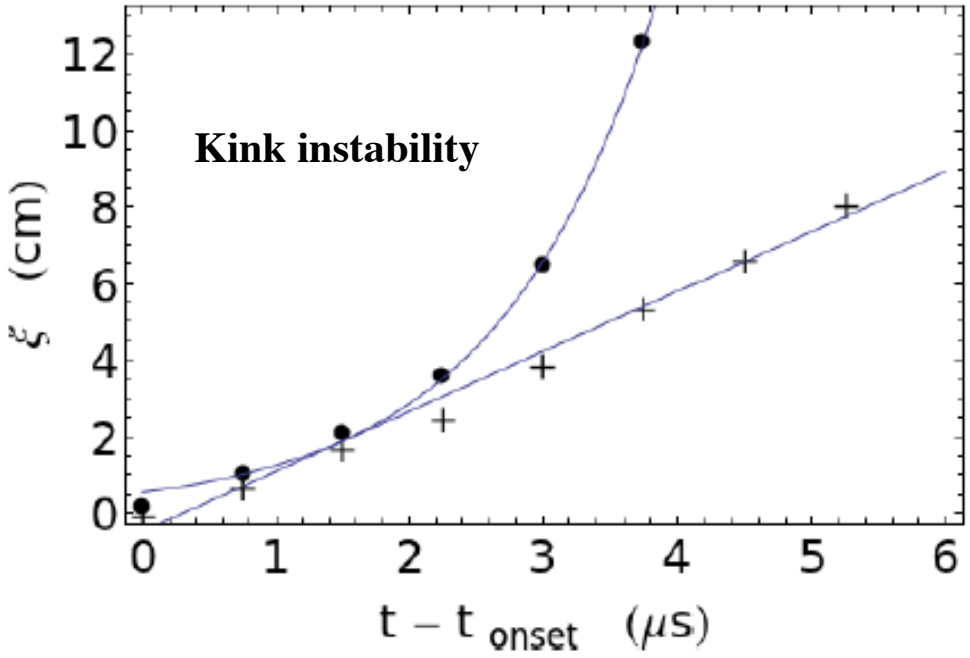
→ Dust Evolution: Formation, Processing, Destruction?

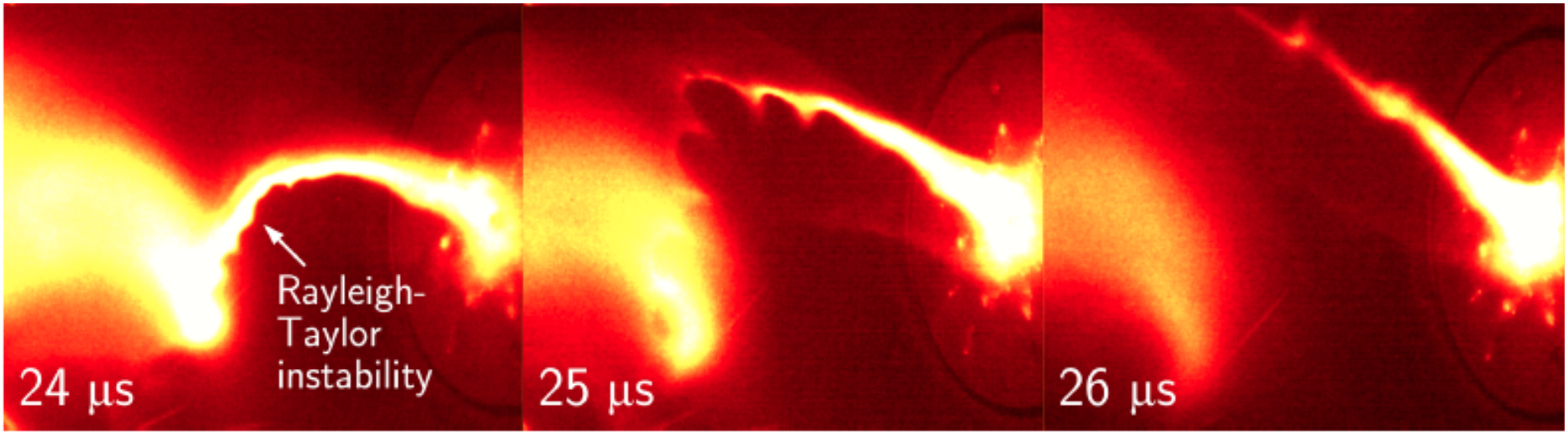


Highlights

Auna Moser:
kink instability + Rayleigh-Taylor instability, magnetic reconnection?

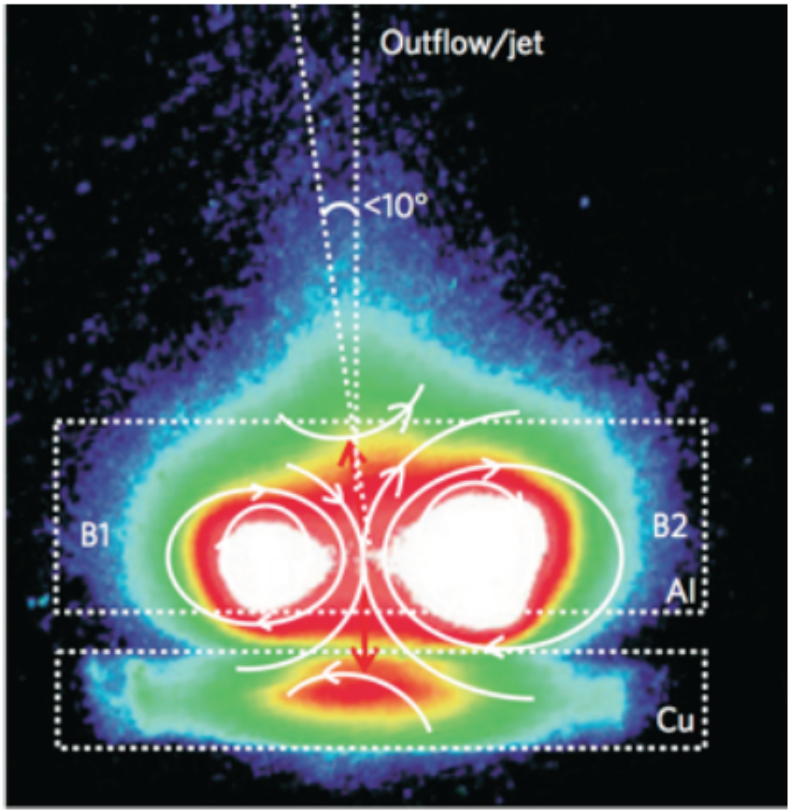






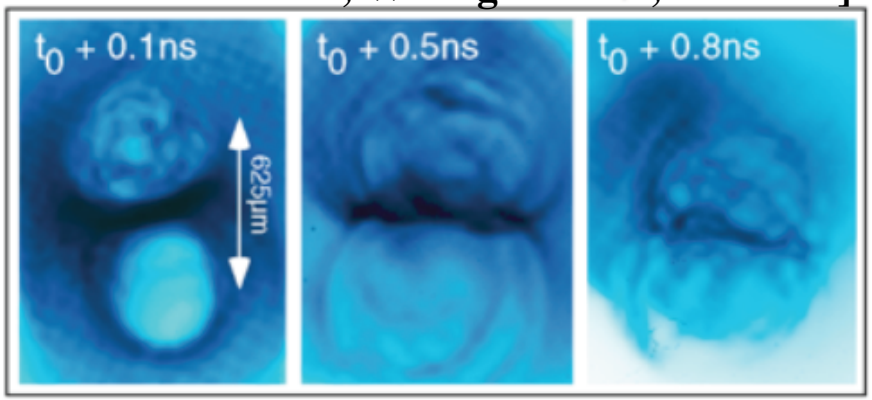
Highlights

Shenguang [Zhong et al., Nature Phys. 2010]

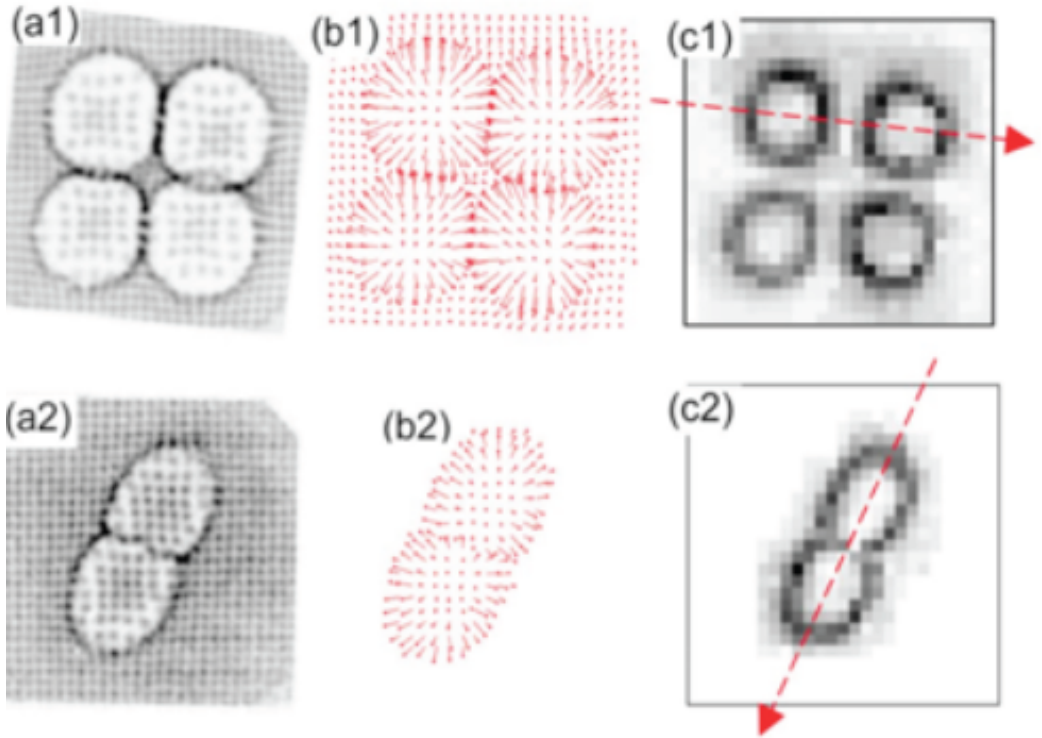


Wil Fox, fast magnetic reconnection in HED laser produced plasmas

Rutherford [Nilson et al., PRL 2006, PoP 2008; Willingale et al., PoP 2010]

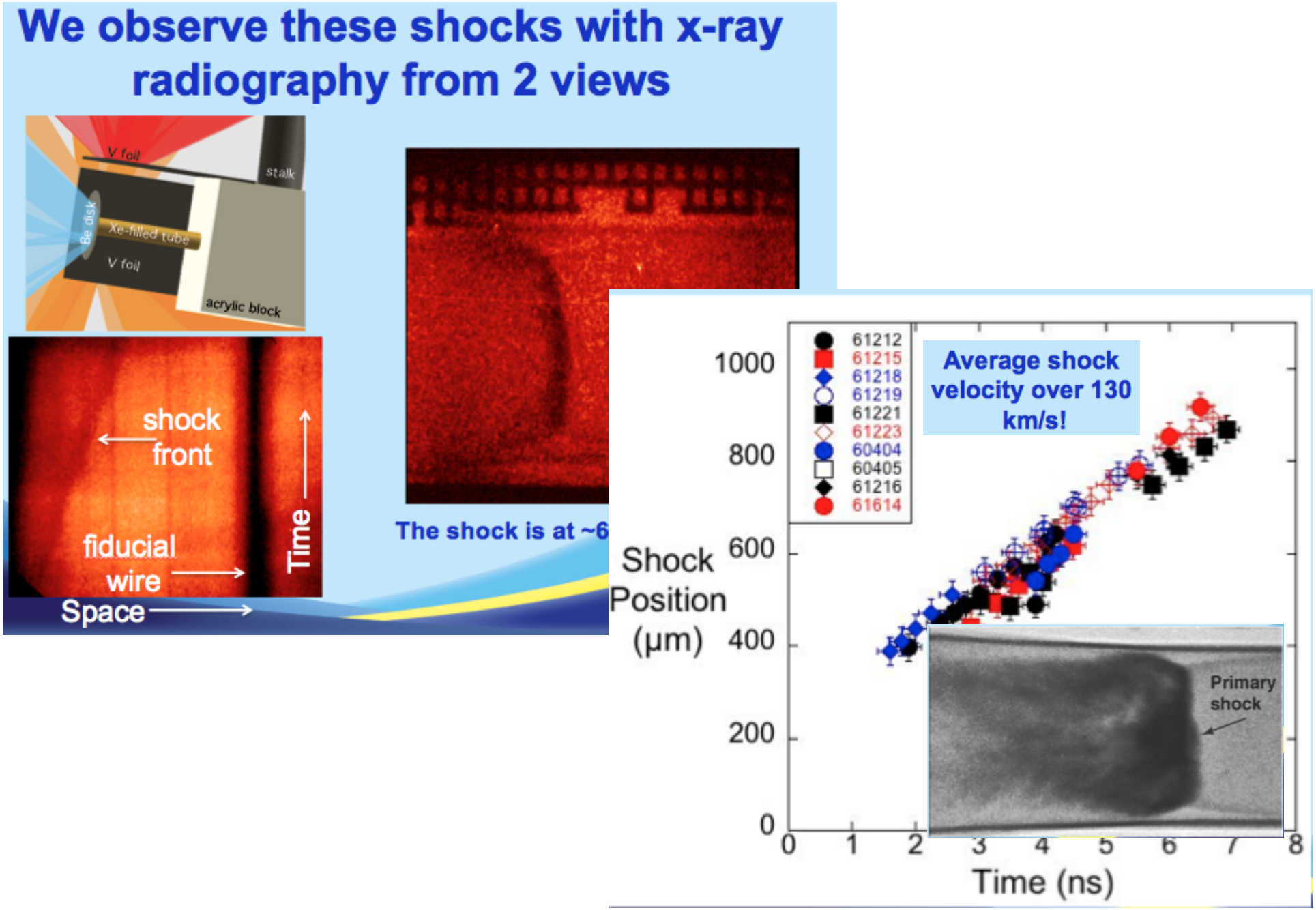


Omega [C.K. Li et al., PRL 2007]



Highlights

Carolyn Kuranz, radiative shocks

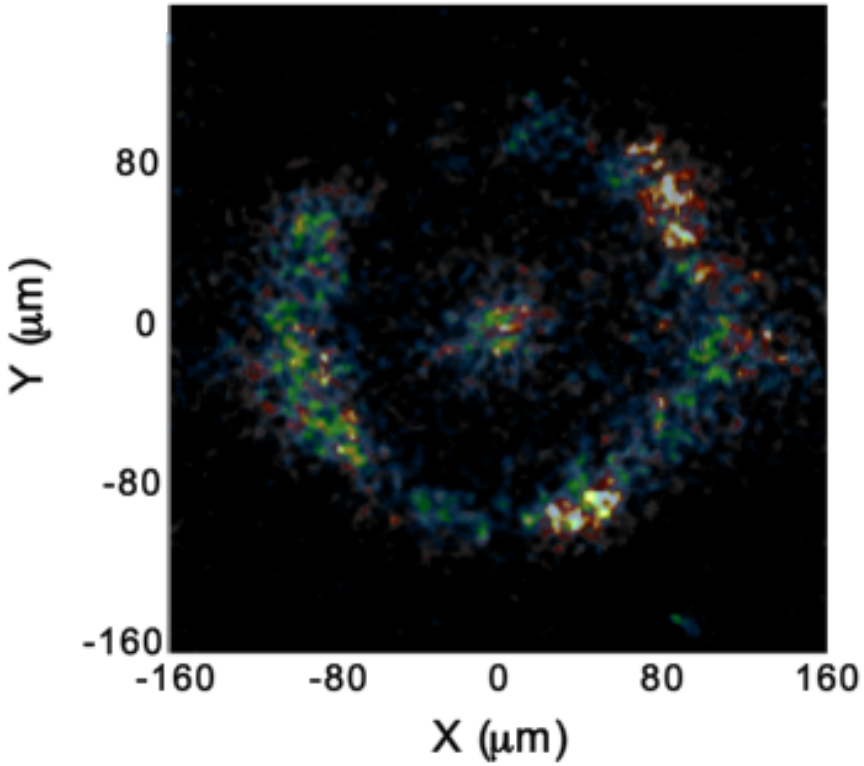


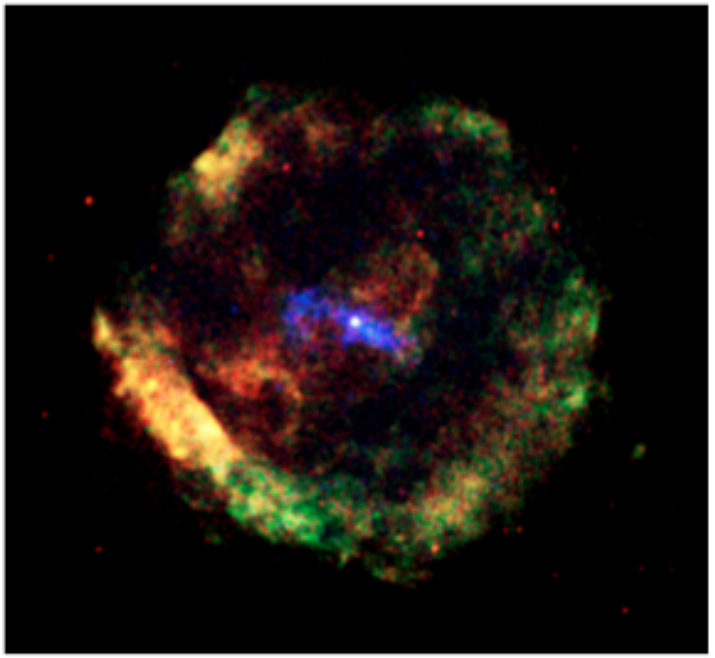
At late time, we observe a radiative shock wave with supernova-like features

X-ray emission at t = 400 ps after peak compression

Super nova remnant G11.2-0.3

Siegfried Glenzer, radiative shocks in NIF implosions





At high pressures of > 20 Gbar, NIF implosions show strongly emitting shock wave [>6 keV filtering]

In Chandra's X-ray image. A shell of heated gas from the outer layers of the exploded star surrounds the pulsar and emits lower-energy X-rays

The goal of HEDLA is to bring two communities together:

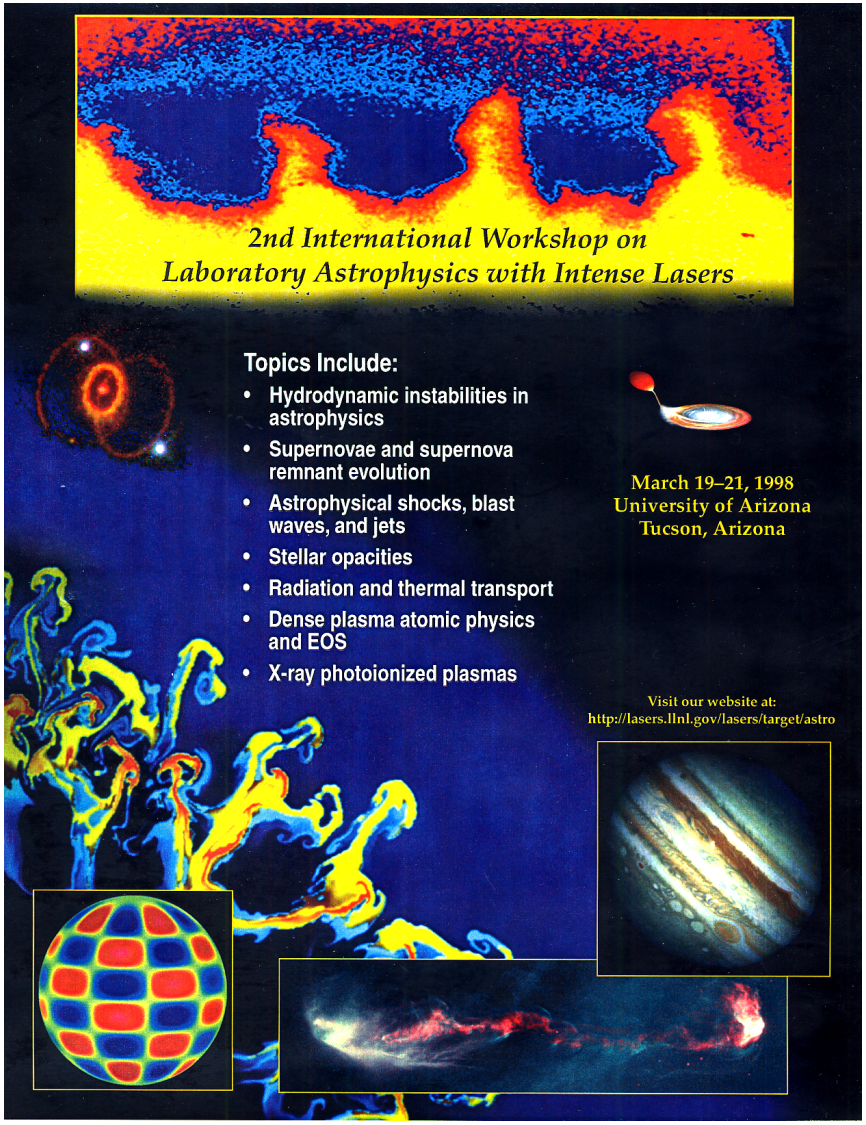
- laboratory experiments and simulations of reality

- astrophysics and astronomy,

to learn from each other, and improve our collective science

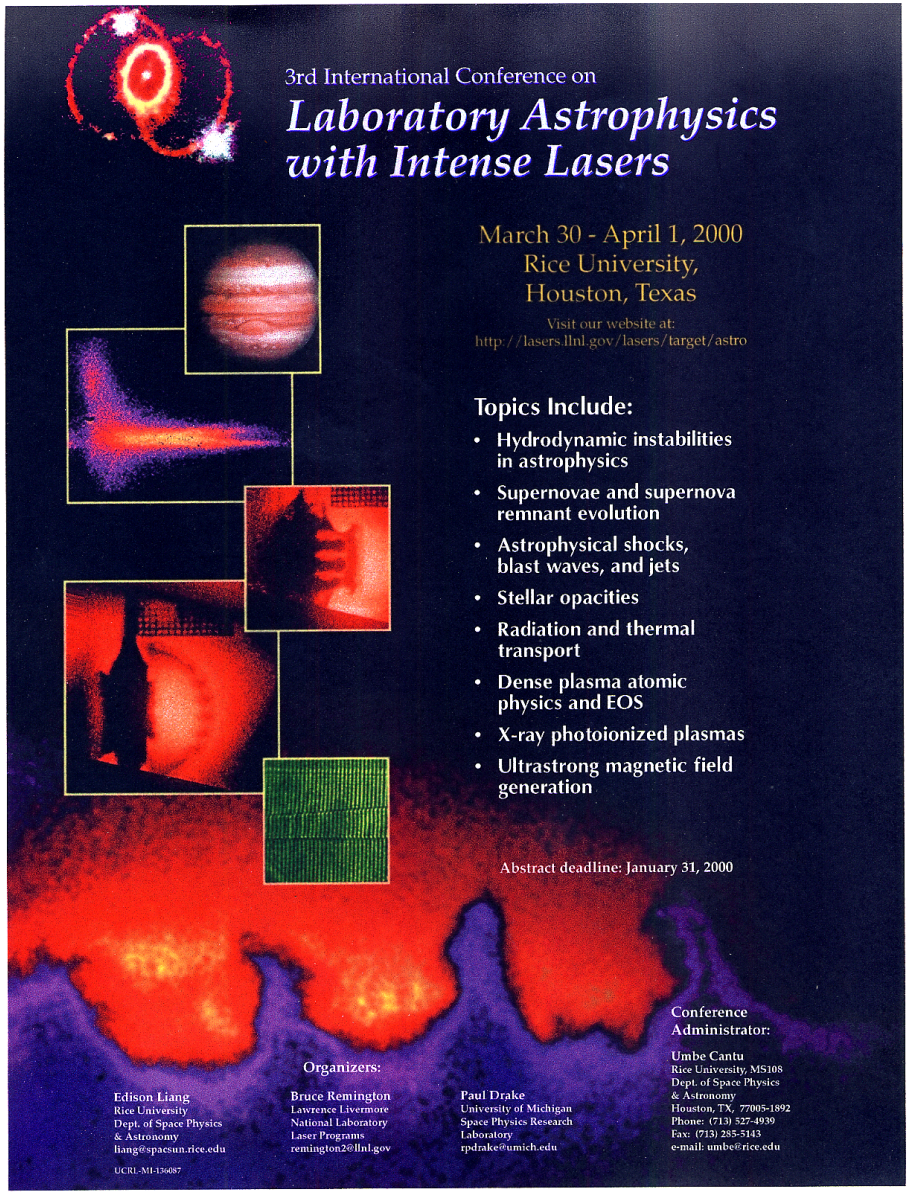
1st HEDLA in Pleasanton, CA in 1996

2nd HEDLA in Tucson in 1998

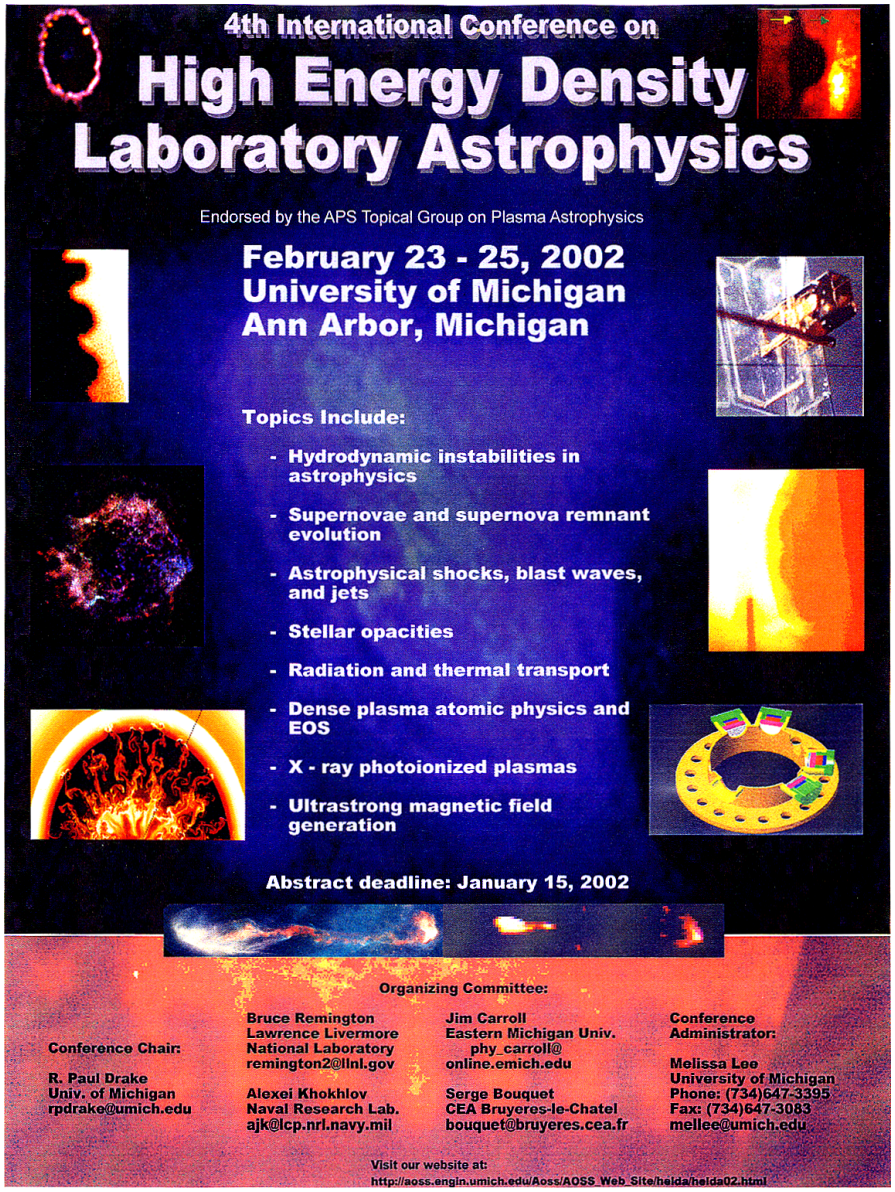


• **Proceedings in Ap. J. Suppl. 127, No. 2 (April, 2000)**

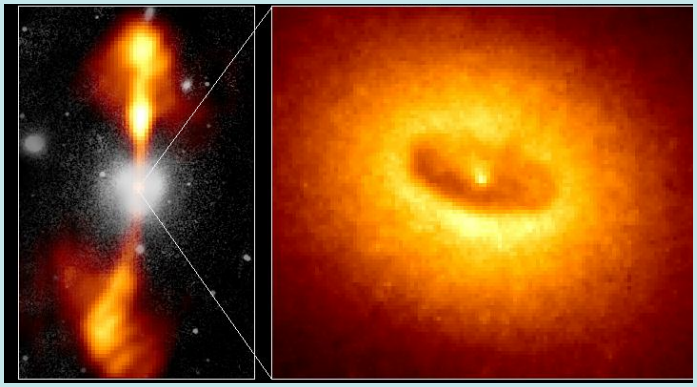
3rd HEDLA in Houston, TX in 2000

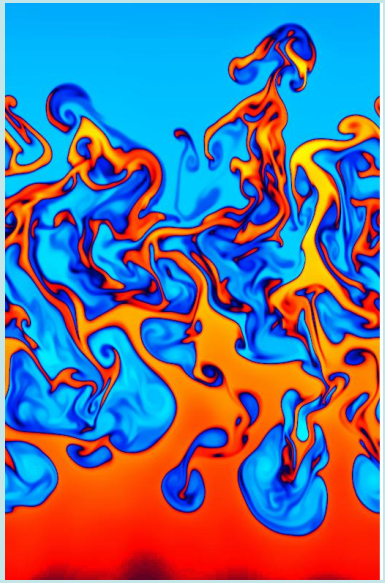


4th HEDLA in Ann Arbor, MI in 2002

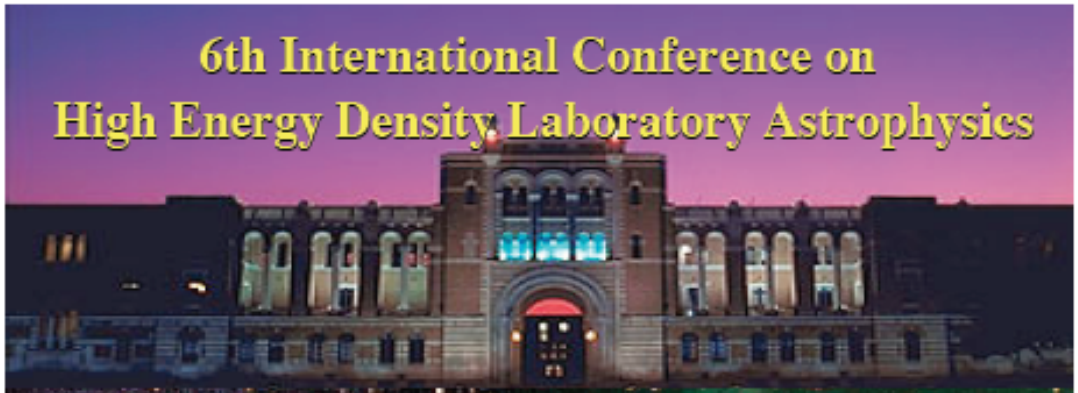


5th International Conference on High Energy Density Laboratory Astrophysics Tucson, Arizona March 10-13, 2004,

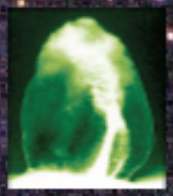


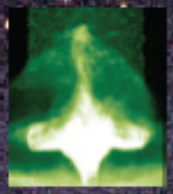


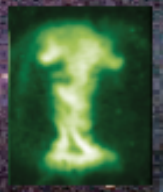
6th International Conference on High Energy Density Laboratory Astrophysics



March 11-14, 2006
Rice University, Houston, Texas



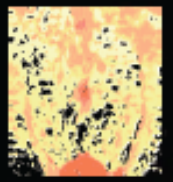




Topics include:

- Stellar evolution, stellar envelopes, opacities, radiation transport
- Planetary interiors, high-pressure EOS, dense plasma atomic physics
- Supernovae, gamma-ray bursts, exploding systems, strong shocks, turbulent mixing
- Supernova remnants, shock processing, radiative shocks
- Astrophysical jets, high-Mach-# flows, magnetized radiative jets, magnetic reconnection
- Compact object accretion disks, x-ray photoionized plasmas
- Ultrastrong fields, particle acceleration, collisionless shocks

Abstract deadline:
January 13, 2006
www.hedla.org



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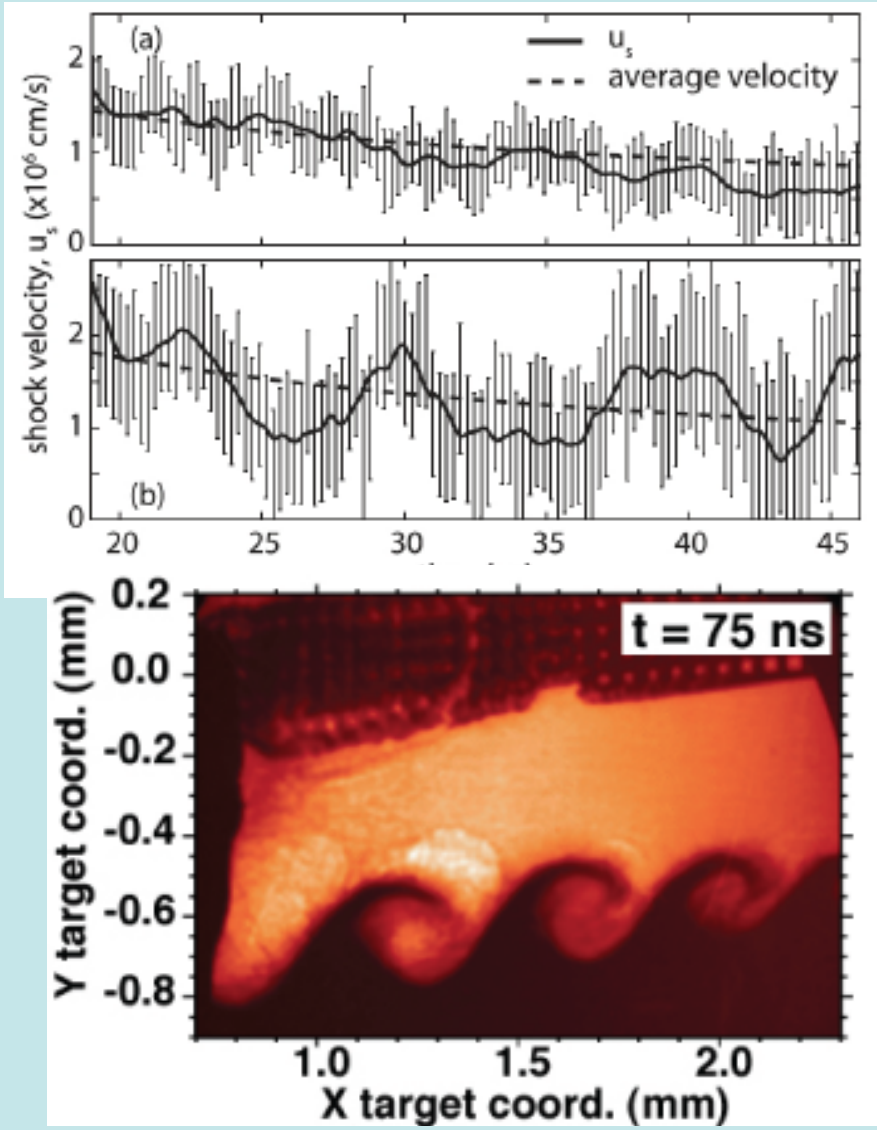
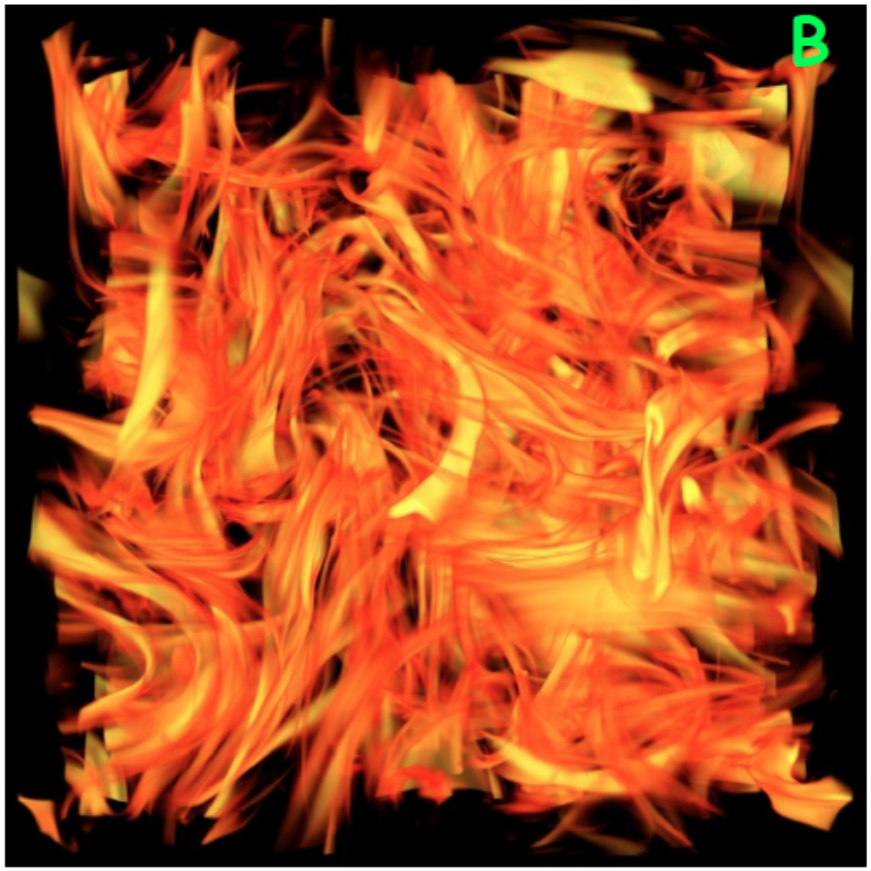
7th International Conference on High Energy Density Laboratory Astrophysics, held jointly with the April APS meeting St. Louis (April 11-15, 2008)

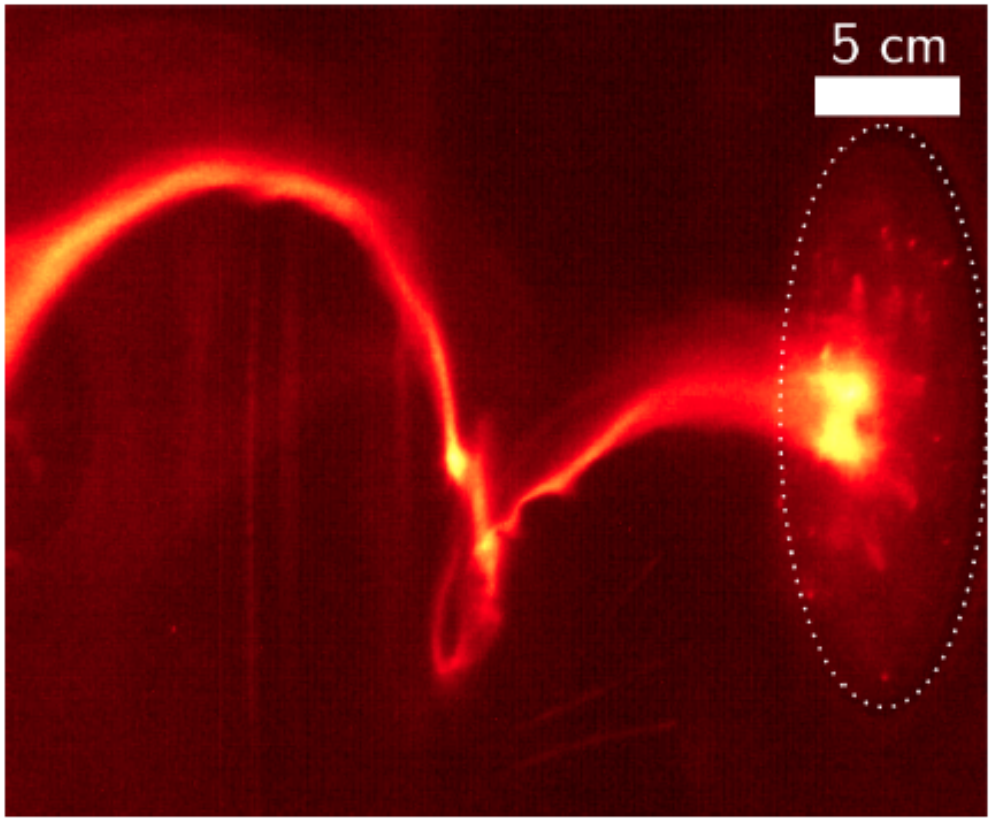
8th International Conference on High Energy Density Laboratory Astrophysics Caltech, Pasadena, CA (March 15-18, 2010)



HEDLA2012

9th International Conference on High Energy D
Tallahassee, FL April 30-May 4, 2012





HEDLA2012

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Tallahassee, FL April 30-May 4, 2012

- Thank you for coming

HEDLA2012

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- Thank you for coming

- Thank you Tomek

HEDLA2012

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Tallahassee, FL April 30-May 4, 2012

- **Thank you for coming**

- **Thank you Tomek**

- **Thank you Marc**

- **Thank you Pat**

- **See you in 2014 in Bordeaux**

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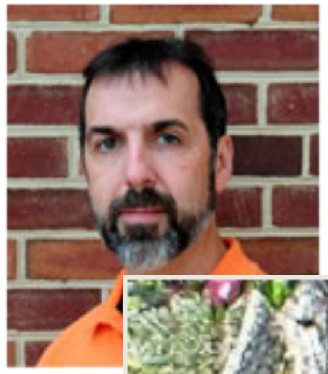
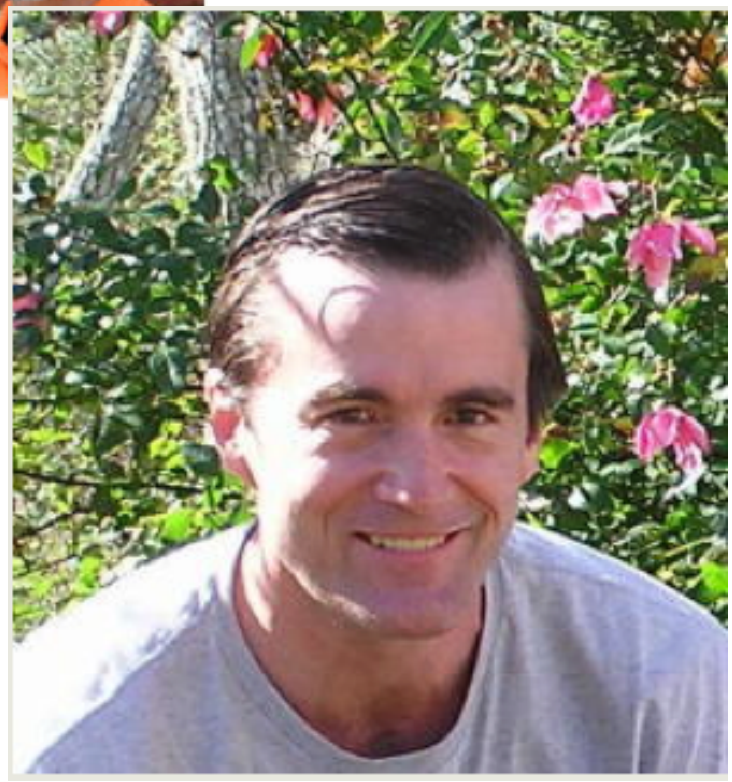
- Thank you Tomek

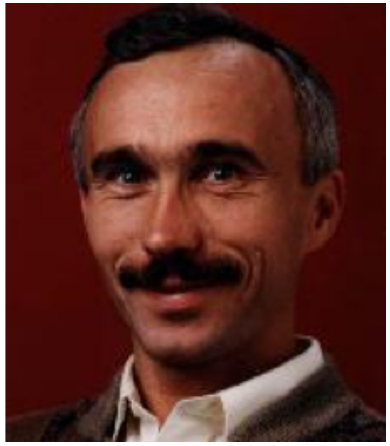


- Thank you Marc

- Thank you Pat



- See you in 2014 in Bordeaux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