



Science at the Kavli Institute

SLUO Presentation

July 11 2003

Kavli Institute

- *Collaboration*

- *Joint initiative by SLAC/campus faculties*
- *Science at the interface of physics and astronomy*
- *Technology from physics and astronomy*
- *Inter-agency collaboration*
- *Local, national and international forum*

- *Novelty*

- *New community of students, postdocs*
- *New approaches to computing and data handling*
- *New projects from new faculty*

Kavli
Institute for
Particle
Astrophysics and
Cosmology

Joint initiative between SLAC and Campus

Occupied by Sept 05

~ => ~10 faculty

~100 people

Information Center

Fred Kavli Building



**New physics building
on campus 08?**



Campus and SLAC

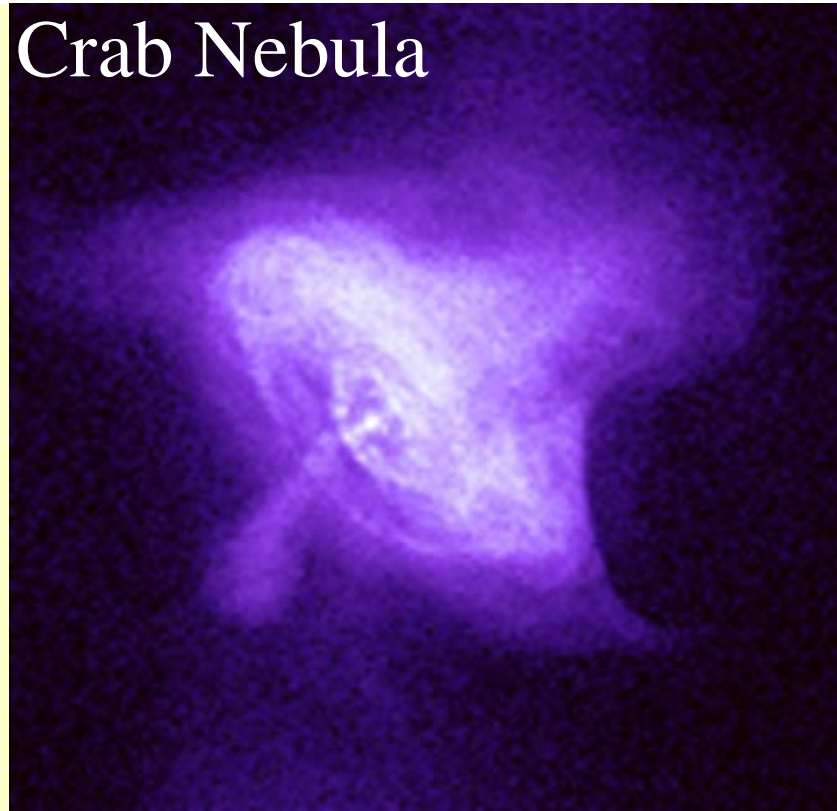
Faculty development plan to ~ ten joint positions by end of decade

- *Balanced experiment/observation theory/computation*
- *Two junior positions advertized*
- *Strong links to other physics/astrophysics groups*
 - *GLAST*
 - *Theoretical Physics*
 - *Accelerator physics (high energy density physics)*
 - *Microwave background*
 - *Dark matter searches*
 - *Gravitational and solar physics*

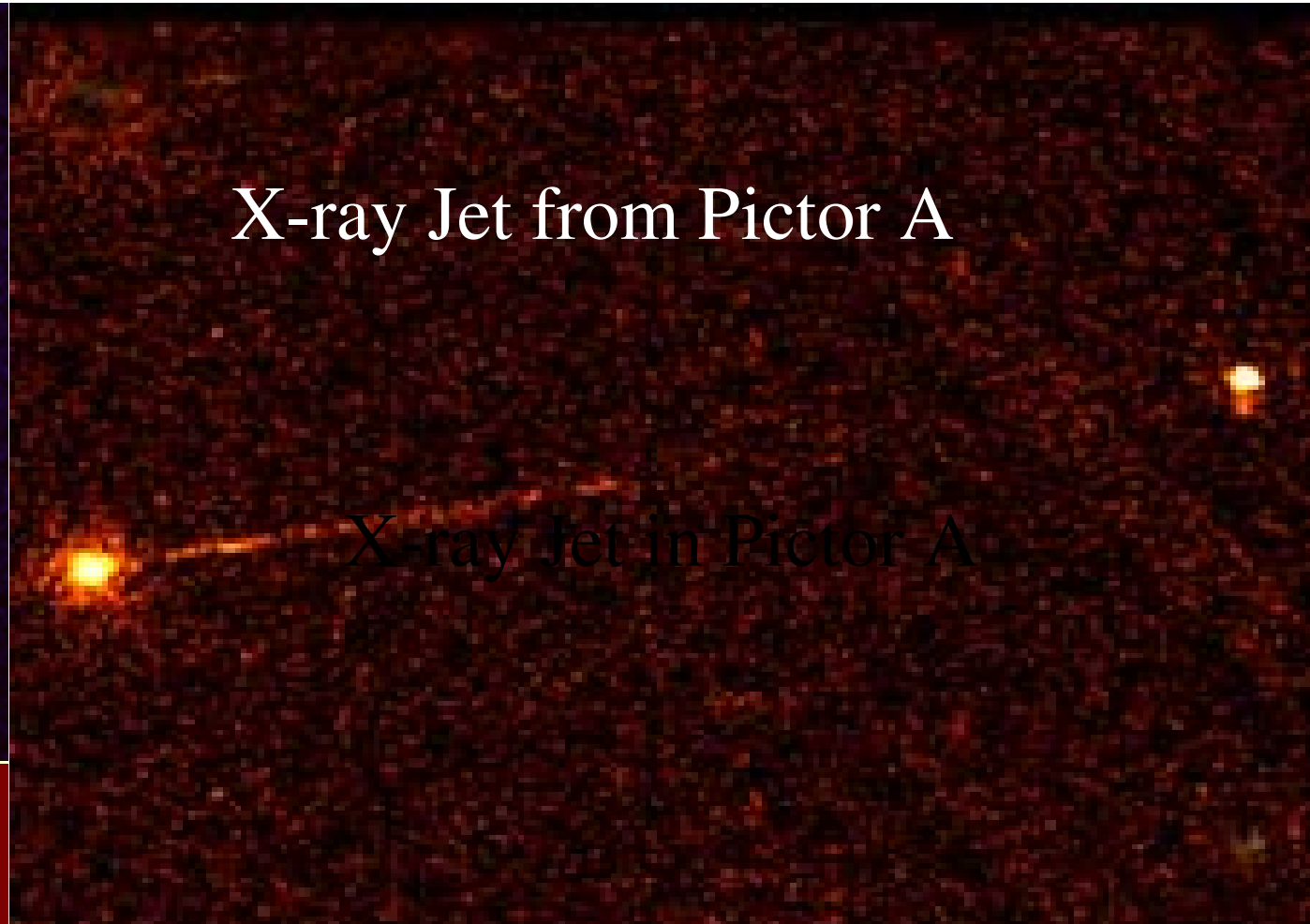
Science at the interface

- *Cosmology*
 - *Dark energy/matter*
 - *Inflation, baryogenesis, leptogenesis, primordial gravitational radiation*
 - *Structure formation from first stars to superclusters*
- *Particle Astrophysics*
 - *Black holes, neutron stars, active galactic nuclei, gamma ray bursts...*
 - *Ultra-high energy cosmic rays, particle acceleration in jets*
 - *Supersymmetric dark matter, massive neutrinos...*

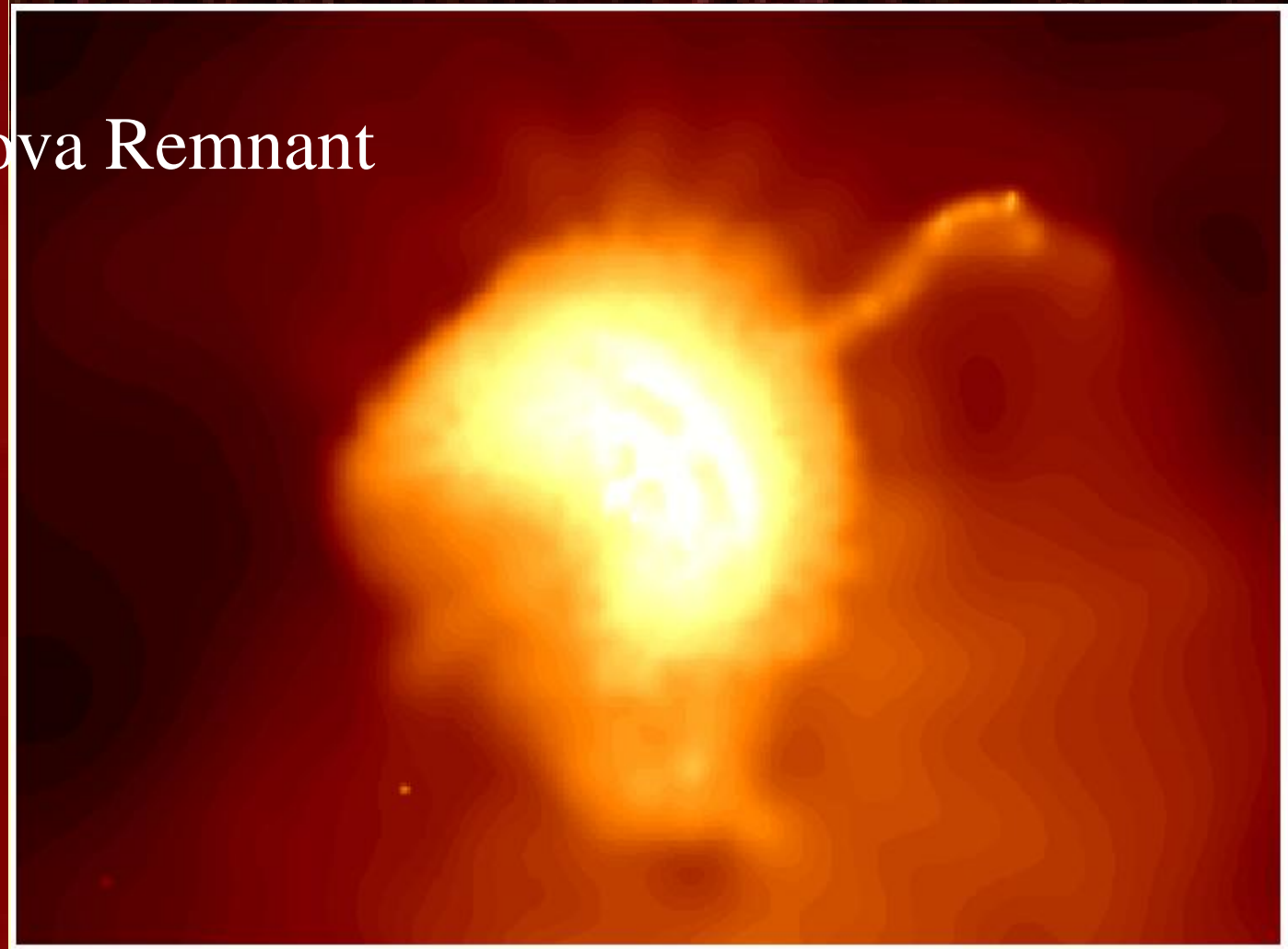
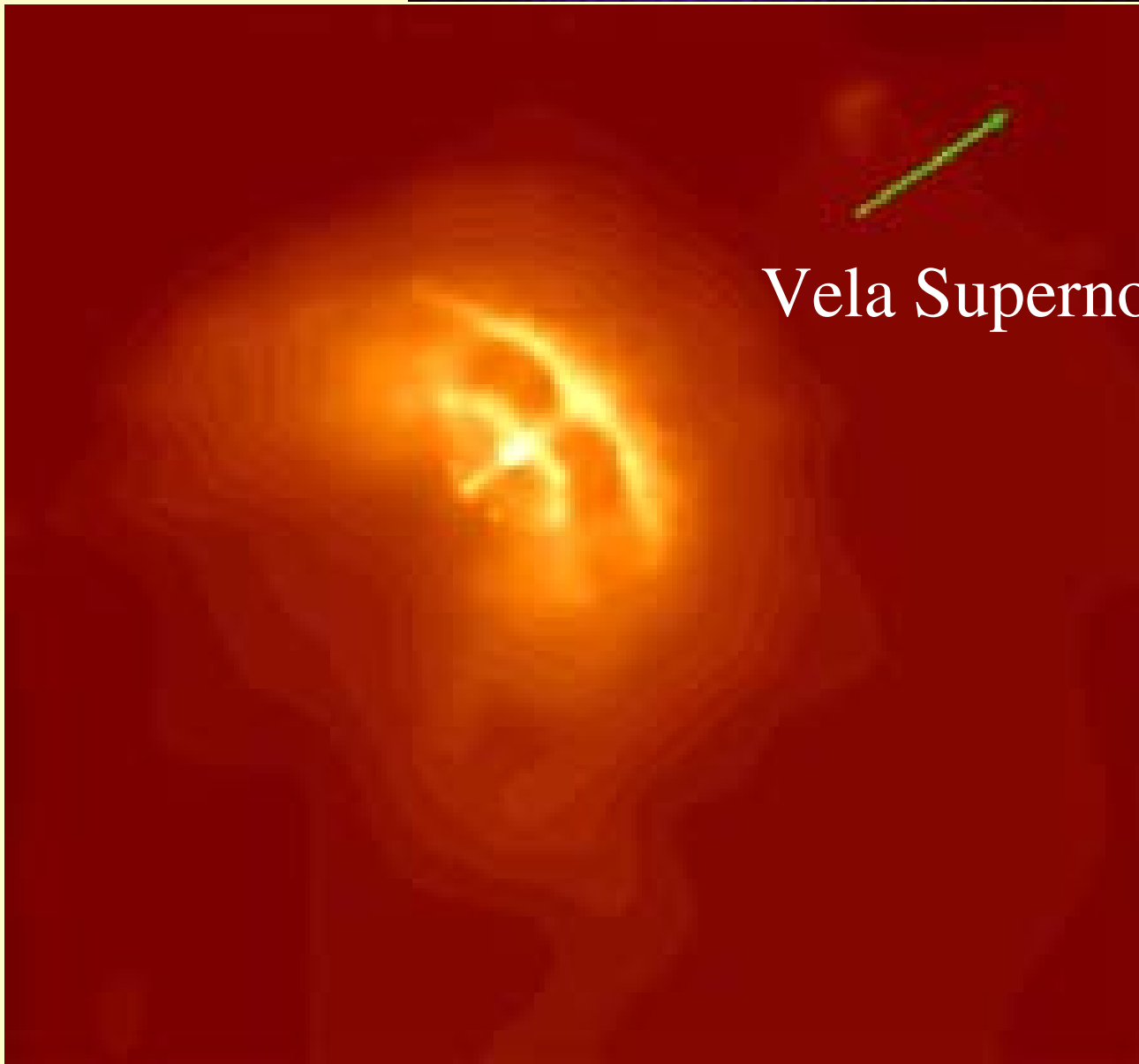
Crab Nebula



X-ray Jet from Pictor A



Vela Supernova Remnant



Technology from Physics and Astronomy

- *Particle physics has special and relevant capabilities*
 - *Detectors eg GLAST*
 - *Data handling eg LSST (>30PB)*
 - *Fast electronics*
- *Astronomers have experience in*
 - *Telescopes (design, construction and siting)*
 - *Optics (X-ray mirrors, adaptive optics)*
 - *Spacecraft integration*

Inter-agency Collaboration

- *GLAST*
 - *NASA+DOE*
- *VERITAS*
 - *NSF+DOE*
- *Gravitational Radiation (LIGO, LISA)*
 - *NSF+NASA*
- *SNAP*
 - *DOE+NASA?*

Kavli Institute as a Forum

- *Local*
 - *“Portal” to contemporary astronomy and cosmology*
 - *Geographical center for Bay area astrophysics (Block Party Oct 03)*
- *National*
 - *Space Part 03 (Dec 03)*
 - *Beyond Einstein meeting (March 04)*
- *International*
 - *Texas Symposium on Relativistic Astrophysics (Dec 04)*

New Community

- *Sept 04 postdocs*
 - *Baltz (dark matter, lensing)*
 - *Frolov (strings, early universe)*
 - *Gu (atomic astrophysics)*
 - *Ho (neutron stars, gravitational radiation)*
 - *Marshall (clusters, microwave background)*
 - *Peterson (clusters, X-rays)*
 - *Sako (X-ray spectroscopy)*
 - *Spitkovsky (high energy, pulsars)*
 - *Many intermittent and short term visitors*
- *Recruiting Students*

New Approaches to Computing

- *Large scale numerical simulation*
 - *Cosmology*
 - *Astrophysical (magneto)fluid dynamics*
 - *Particle acceleration and plasma physics*
- *X-ray data analysis facility*
 - *Transition to gamma -ray facility for GLAST*
- *Large scale data handling eg for LSST*
 - *30 PB !*
 - *Rapid response to transients*

New Projects

- *General Principles:*
 - *Compelling science*
 - *Good fit to KIPAC interests, both scientifically and technically*
 - *Good fit to agency goals*
 - *Value-added from Kavli-involvement*
 - *“Play the field”*

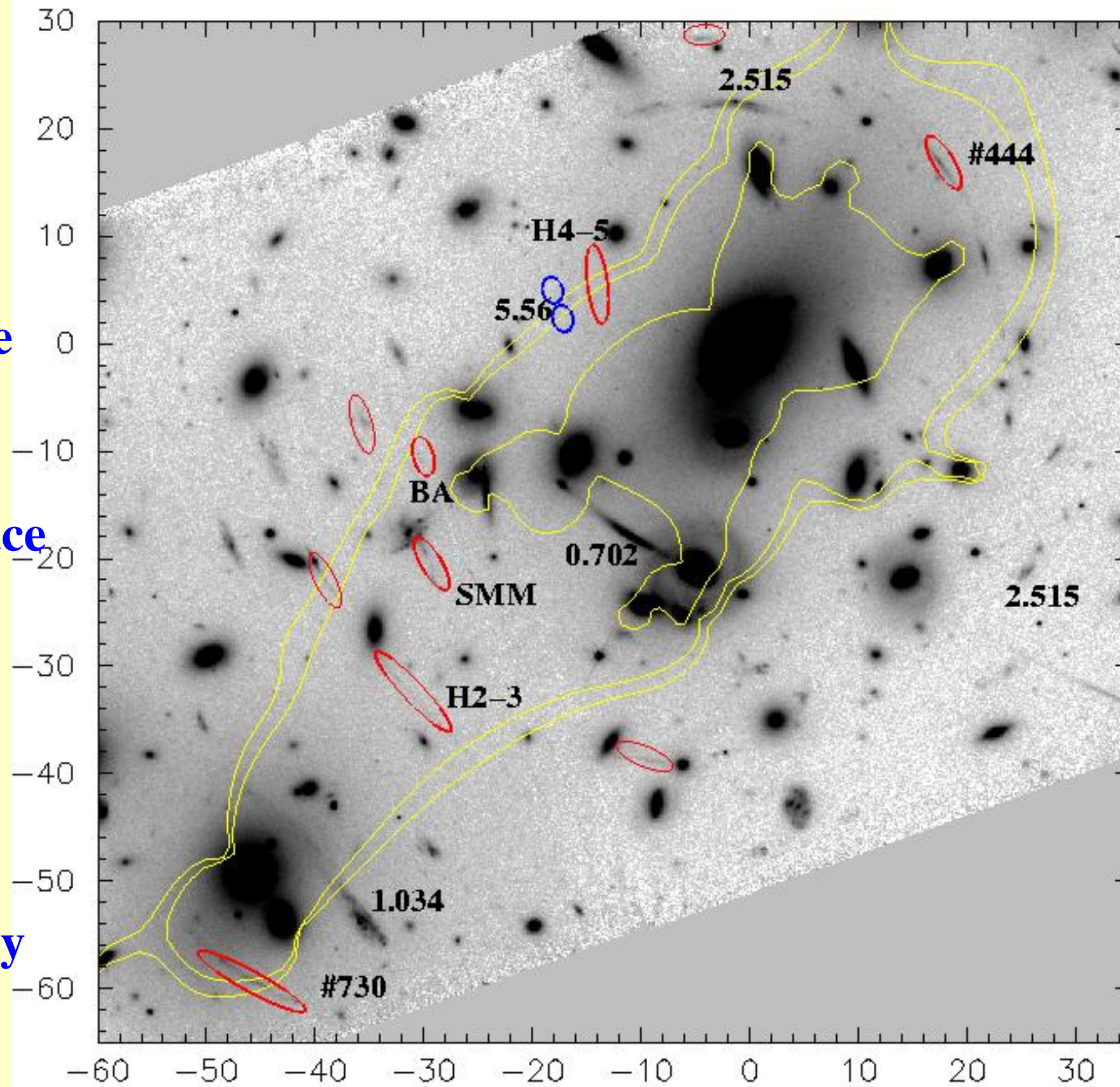
Existing Projects

- *SNAP*
- *LSST*
- *EXIST*
- *Alphabet soup*

**A. Match faint source
pairs, quads, arc
fragments etc to
derive accurate surface
potential.**

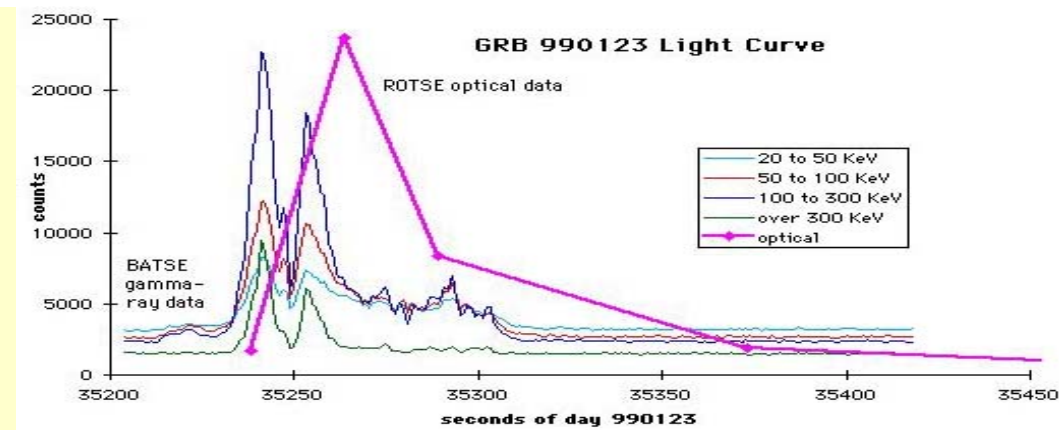
**B. Measure more z's
to get very accurate
 $D_{ds}/D_{os}(z)$ and
perform cosmography**

**C. Ultimate goal is to
get $a(t)$.**



Strong Lensing

Gamma-ray Bursts



- *Supernova scale explosions probably involving formation of black holes with petagauss fields*
- *Release energy in seconds emit as gamma rays*
- *Relativistic jets lasting a year making afterglow*
- *Direct association for supernovae*
- *High polarization detected by RHESSI => organized electromagnetic field*
- *May accelerate UHE CR (50J)*
- *Rapidly developing field elucidating pulsars and quasars*
- *Prime target for GLAST*

Summary

- *KIPAC already on the road*
- *Joint initiative on several fronts*
- *Outstanding and soluble problems*
- *Excellent scientific staff starting in September*
- *Fred Kavli building by Sept 05*
- *Use us as a portal to the world of cosmology and astrophysics and be patient as we try to learn more about your world!*