SuperNova/Acceleration Probe: An Overview

http://snap.lbl.gov

An Experiment to Measure Cosmological Parameters and Investigate the Properties of the Dark Energy.

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SNAP Science Mission

Science

- Measure Ω_M and Ω_Λ
- Measure w and w (z)

Statistical Requirements

- Sufficient (~2500)
- ...distributed in redshift
- ...out to z ~ 1.7

Systematics Requirements

Identified & proposed systematics:

- Measurements to eliminate / bound each one to <0.02mag

Data Set Requirements

- Discovery 3.8 mag before max.
- Spectroscopy at peak brightness.
- Coverage from 0.4 to 1.7 microns.

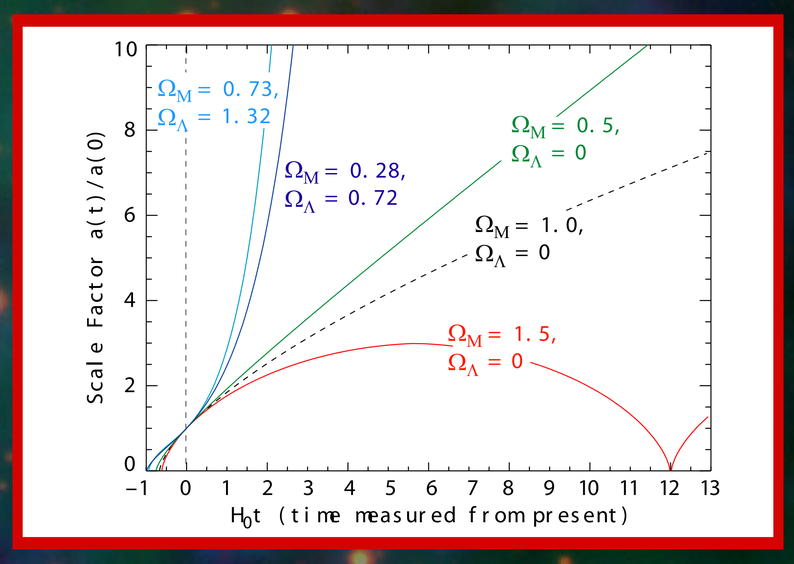
Satellite / Instrumentation Requirements

- ~2-meter class telescope
- 1-square degree imager
- Low resolution spectrograph

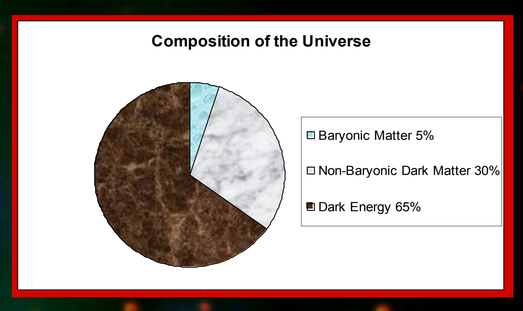
Derived requirements:

- High Earth orbit
- ~50 Mb/sec bandwidth

SNAP and the Accelerating Universe

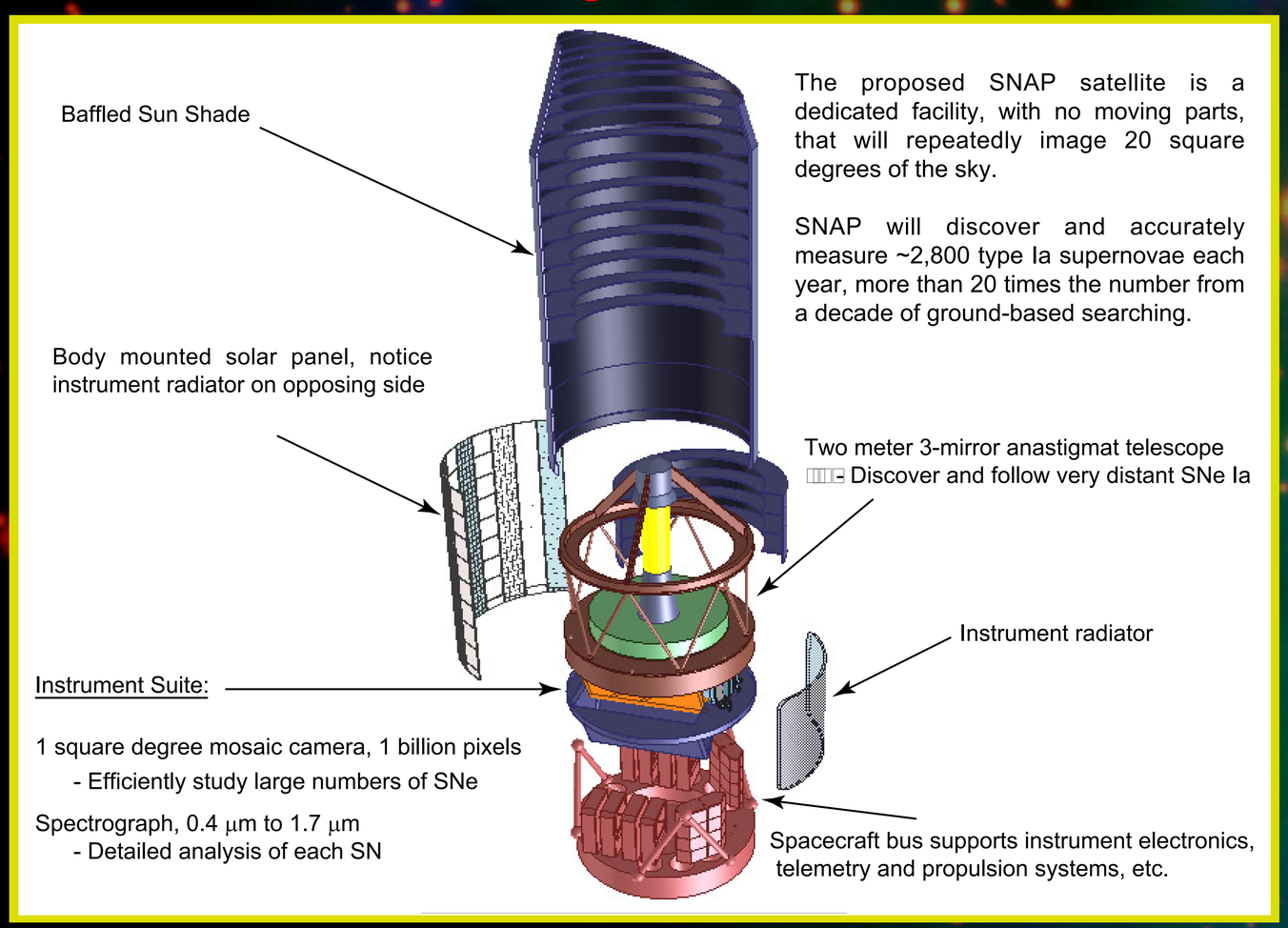


SNAP's primary science goal is to measure the expansion history of the universe, exploring the characteristics of the "dark energy" which appears to accelerate the expansion.



Evidence for an accelerating universe was discovered in 1998 by the Supernova Cosmology Project and the High-Z Supernova Team. Such an acceleration requires a form of energy with a substantially negative equation of state, perhaps the cosmological constant, suggesting new particle physics, or a new theory of gravity. Either way these astrophysical investigations will push back the frontiers of fundamental science. SNAP is one of very few experiments that can study the dark energy directly and test the cosmological constant against alternative dark energy candidates.

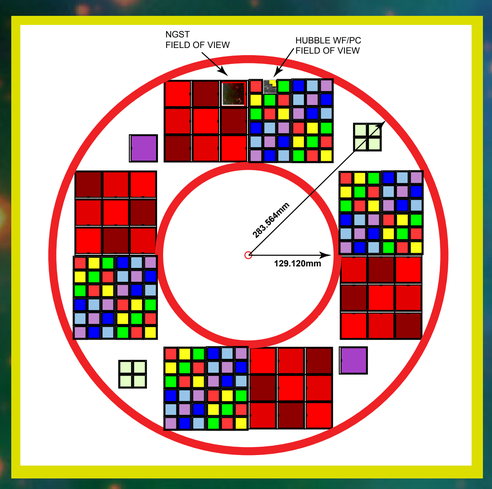
SNAP Observatory Design



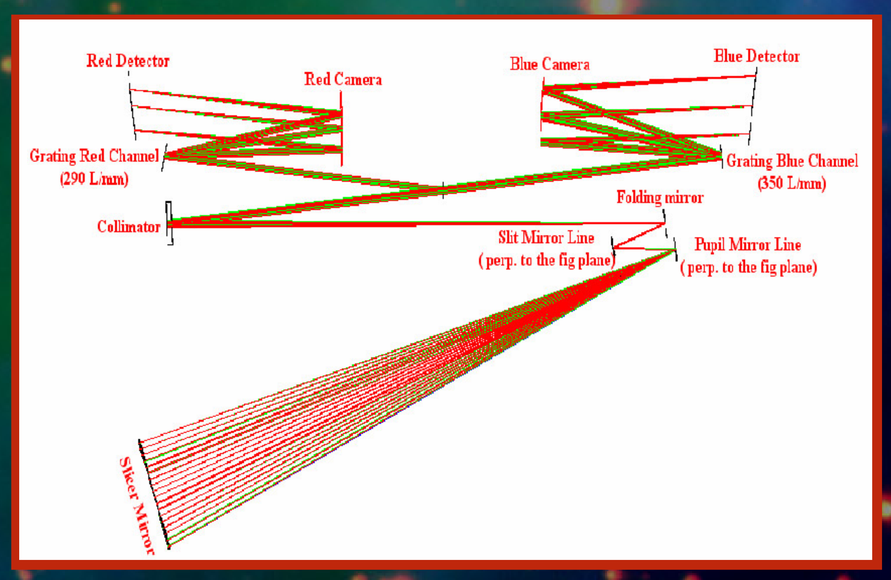
The proposed SNAP satellite is a dedicated facility, with no moving parts, that will repeatedly image 20 square degrees of the sky.

SNAP will discover and accurately measure ~2,800 type Ia supernovae each year, more than 20 times the number from a decade of ground-based searching.

SNAP Instrumentation Suite



A key technological innovation is a large one billion pixel detector array: GigaCAM, the largest astronomical imager ever. GigaCAM's high sensitivity, one square degree camera will routinely provide deep, wide field images 13,000 times the area of the Hubble Deep Field and two magnitudes fainter.



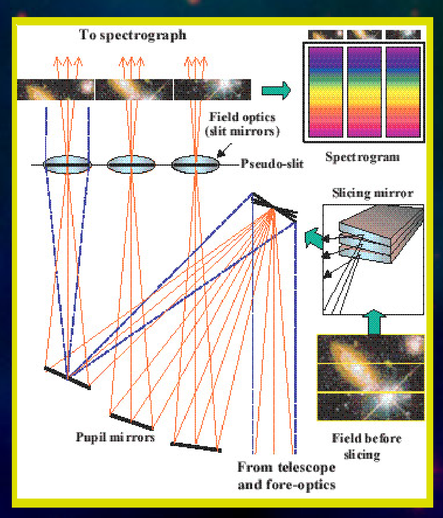
The SNAP Orbit

Key features of the SNAP orbit include: passive cooling and minimization of thermal changes, stray light, and radiation exposure. SNAP is designed to fit within the faring of a Delta III or Delta IV launch vehicle.

Telemetry design allows continuous data downlink to northern hemisphere receiving stations.

SNAP Astronomy

- Galaxy Structure, Populations and Evolution
- Weak Gravitational Lensing
- Strong Gravitational Lensing
- Galaxy Clusters
- Gamma Ray Burst Afterglows
- Transient Objects
- Stellar Distributions, Populations and Evolution
- Solar System Studies
- Multiband Deep Survey
- Time Domain Survey



SNAP's Spectrograph is designed for the wavelength range 0.4 μm to 1.7 μm (3D view). This design uses a slicer (left figure) to image the target onto the slit. Downstream the light is split by a dichroic into red and blue channels. The final product is a spatial/spectral data cube. Spectrograph design by E. Prieto, Observatoire d'Astrophysique de Marseille.

SNAP is supported by the US Department of Energy Office of Science, Division of High Energy Physics

The Dumbell Nebula, taken with the LBNL CCD on the WIYN Telescope
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