Quick Introduction to Big Boss

FCPA 2010 “Retreat”

Acknowledgements

- David Schlegel for many science slides
- Steve Kent for p.s.f. calculations
- Brenna Flaugher
- Darren Depoy

Big Boss in 1 slide

- LBNL leads Big Boss, an idea for a Dark Energy Task Force Stage IV experiment proposed in answer to an NOAO AO to provide a wide-field instrument for the Mayall
- Baryon Acoustic Oscillations from spectroscopic measurement of 50M galaxies 0.2<z<2.0 and 1M QSO with 2<z<3 (D.S.'s talk located at the link below)

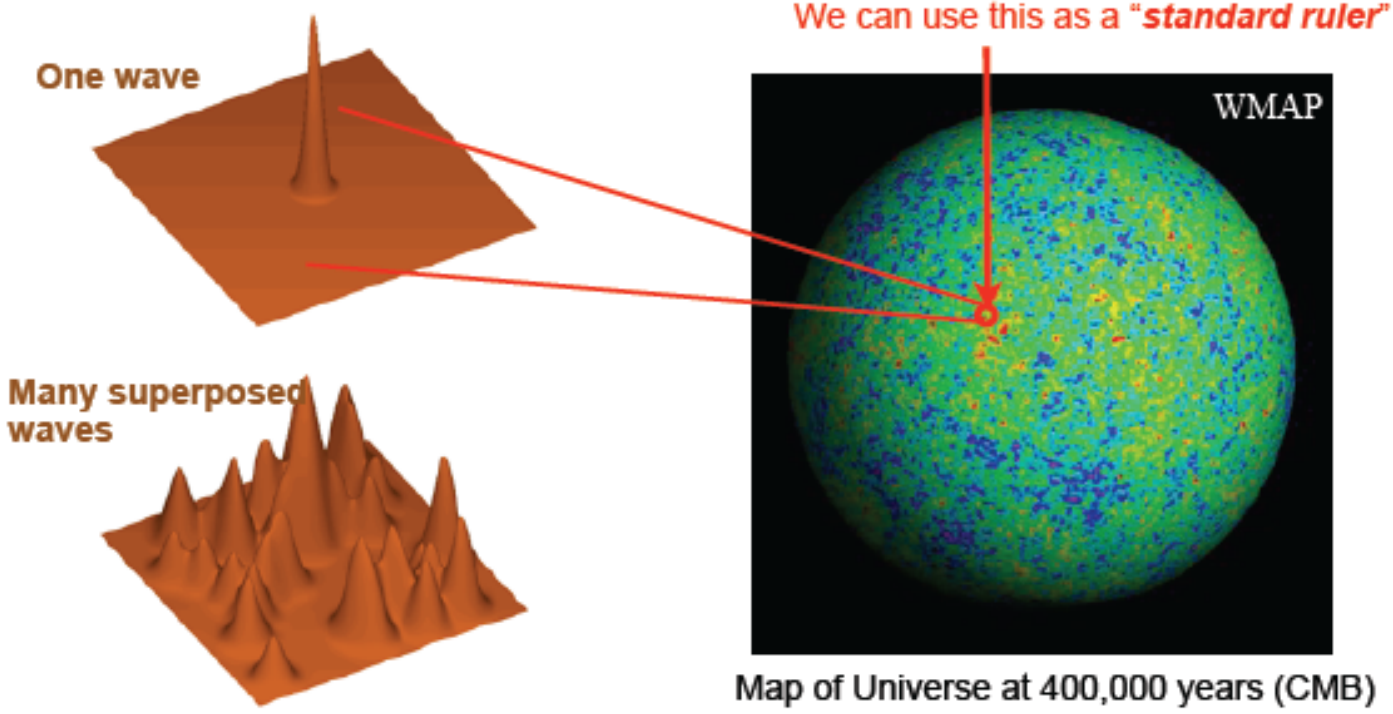
https://bigboss.lbl.gov/trac/wiki/Public-BBScience-11-18-09

Big Boss Science

Baryon Acoustic Oscillations (BAO)

Sound waves traveled 500 million light years in the plasma of the early Universe, then abruptly stopped.

We can use this as a "***standard ruler***"



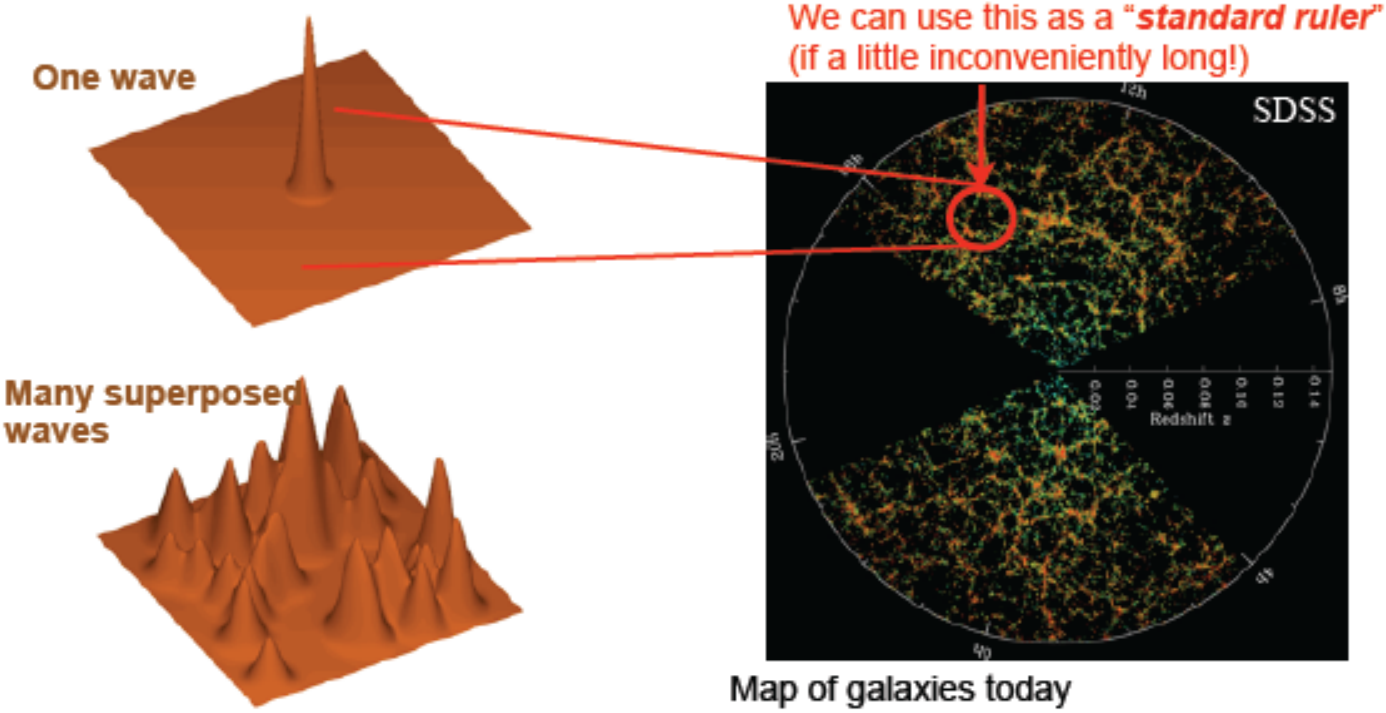
Slide from D. Schlegel

BAO

Baryon Acoustic Oscillations (BAO)

Sound waves traveled 500 million light years in the plasma of the early Universe, then abruptly stopped.

We can use this as a "***standard ruler***" (if a little inconveniently long!)



Map of galaxies today

Slide from D. Schlegel

BAO

Baryon Acoustic Oscillations (BAO)

Precision dark energy probe from BAO scale

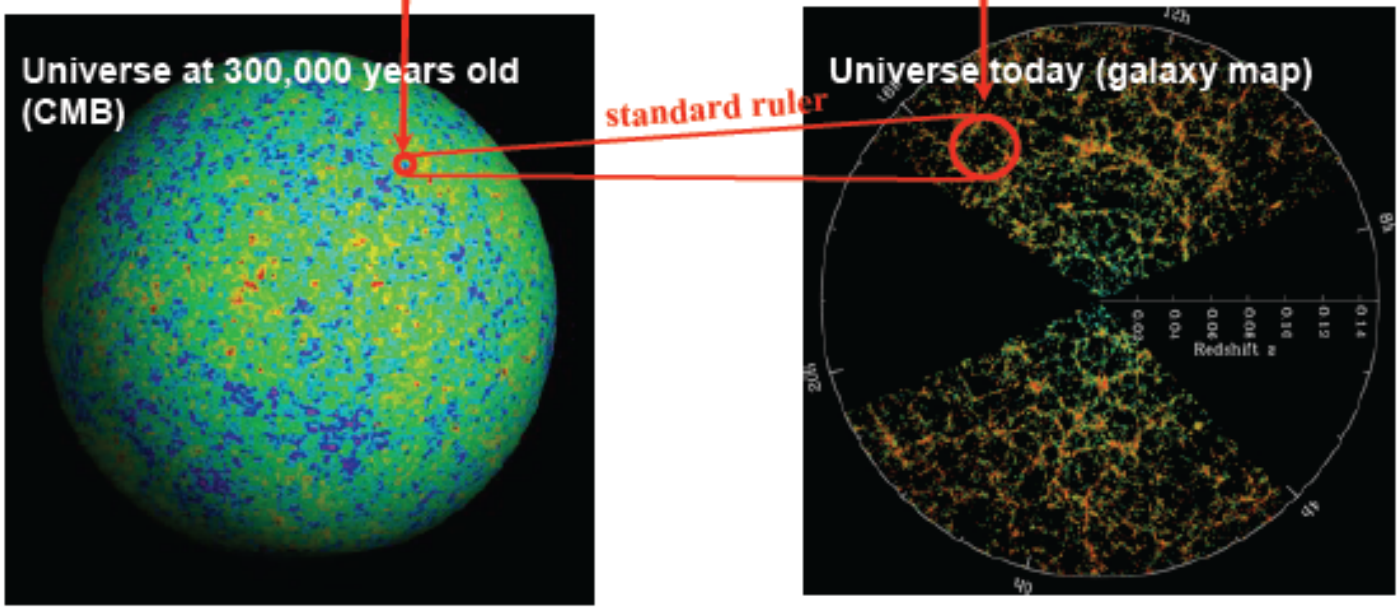
Inflation probe from non-gaussian fluctuations

- Better than Planck or JDEM

D.Schlegel

These fluctuations of 1 part in 10^5 gravitationally grow into...

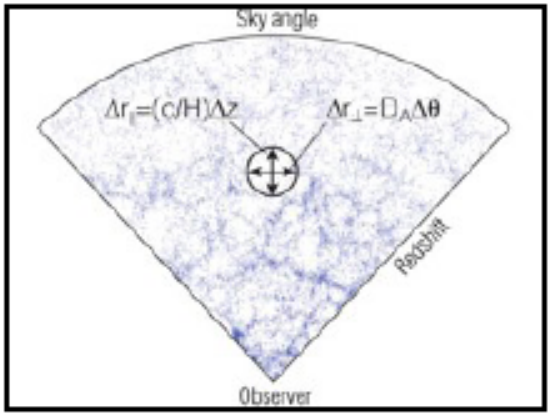
...these ~unity fluctuations today

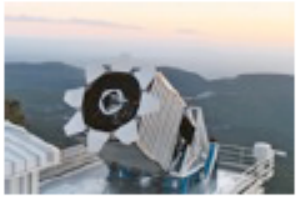


Big Boss Science

What we like...

- Like supernovae, a geometrical probe of the expansion rate (and dark energy)
- The acoustic oscillation scale depends on the sound speed and the propagation time
- Anchored at recombination (z=1088) by the CMB
- **Orientation of ruler provides two different probes**
  - **Transverse rulers probes $D_A(z)$**
  - **Line of sight rulers probe $H(z)$**
- These depend on the matter-to-radiation ratio ($\Omega_m h^2$) and the baryon-to-photon ratio ($\Omega_b h^2$)
- Only need to make 3D maps (angles + redshifts)



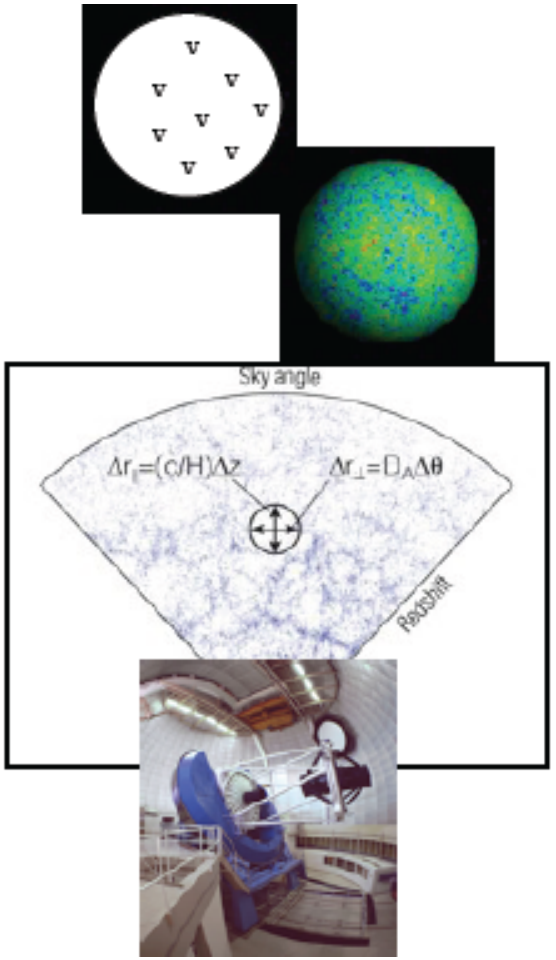


What we don't like...

- Ruler is inconveniently long → 150 Mpc = 450 million light years
- **Statistical measure of a small signal → Requires mapping millions of objects**
- There is a cosmic variance limit... once we reach that, we're done!

Slide from D. Schlegel

Big Boss



BAO: What tracer objects to use?

$z=10^{11}$ Neutrino background
(not for BAO ruler, but horizon at v decoupling)

$z=1087$ CMB: Planck will measure d_A to 0.1%

$z=20$ H gas in 21-cm emission

$z=5$ Ly-A emitter galaxies
QSO absorption lines

$z=2$ Galaxies,
galaxy clusters,
SNe

$z=0$

All existing BAO measurements

Definitely the hard way, but it's been suggested!
(Angulo et al 2006)
(Zhan et al 2008)

Slide from D. Schlegel

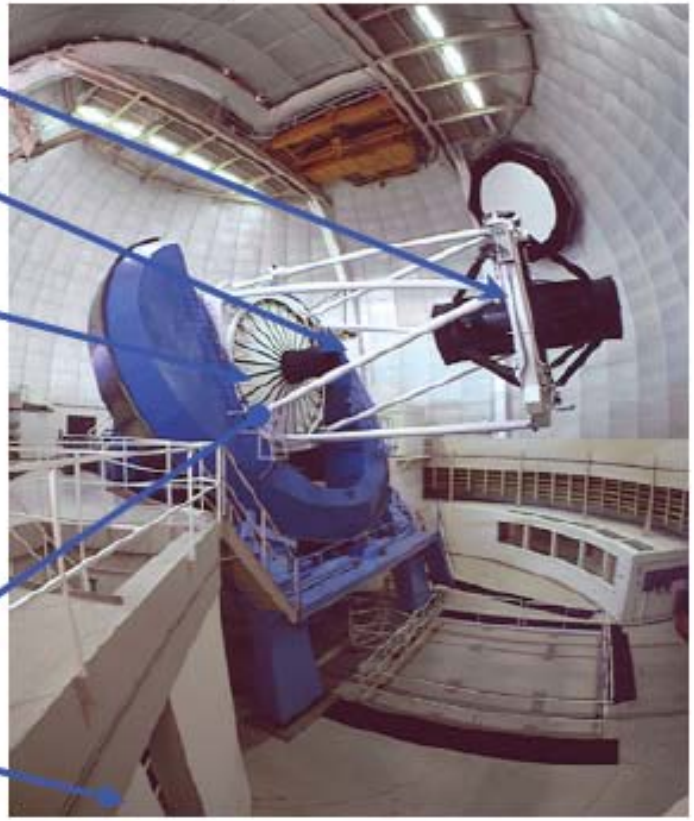
Big Boss

- Big Boss Science Goals
  - BAO z=0 to 3.5 near cosmic variance limit
  - RSD z=0 to 3.5
  - Galaxy density map for WL
  - Detect non-Gaussianity, use low-b + high-b sources
- Big Boss Design Philosophy
  - Optimize for z's only
  - Simple design ⇔ high throughput
  - "Full-sky"

Slide from D. Schlegel

Big Boss Instrument Overview

Kitt Peak 4-m (Mayall) at Kitt Peak, Arizona

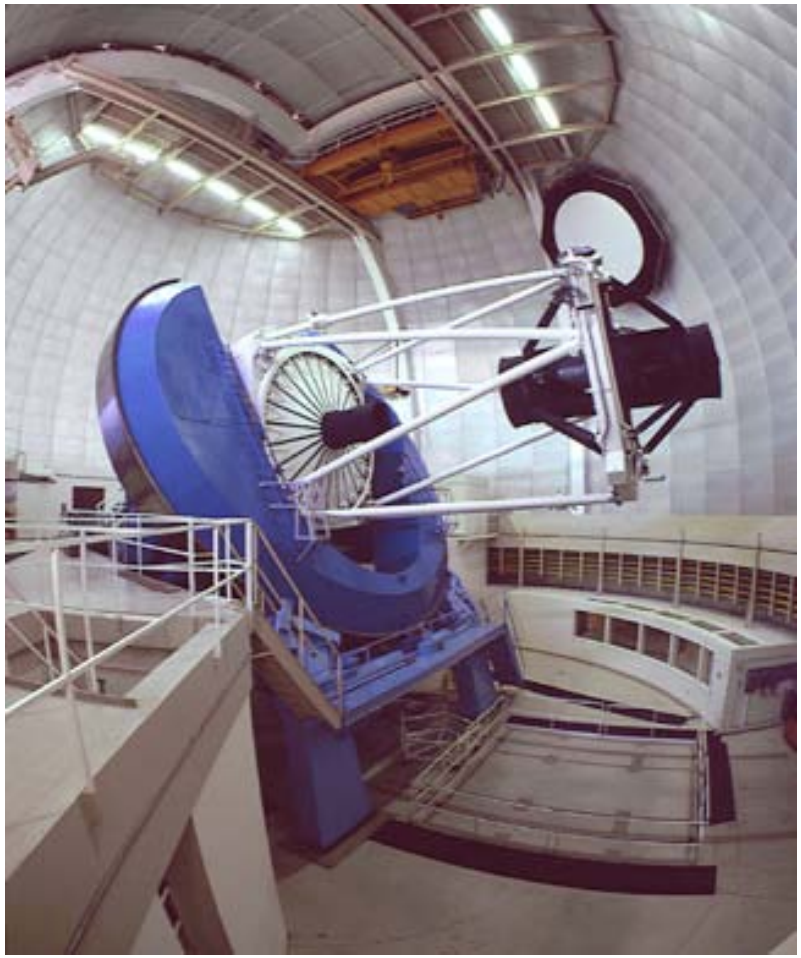


SDSS-inspired:
simple, high-throughput

Slide from D. Schlegel

Instrument Contributions?

- Using our experience on the Blanco, help B.B. with mechanical/infrastructure issues
  - Telescope optics mounting and cage Ass'y
  - Optical fiber and cable routing
  - CCD Testing but maybe not packaging?
  - Impressed by TS, integration or maybe even something more elaborate, say, including the optics testing



Strengths & Weaknesses

- Strengths
  - Proposal modeled after DECam
  - Institutions from SDSS, Boss, and DES
  - Technically possible to build Big Boss
- Weaknesses
  - Not in the South
  - Overreaching on the size of the FP
  - Light collection efficiency is important
  - Expensive (~$70M?)

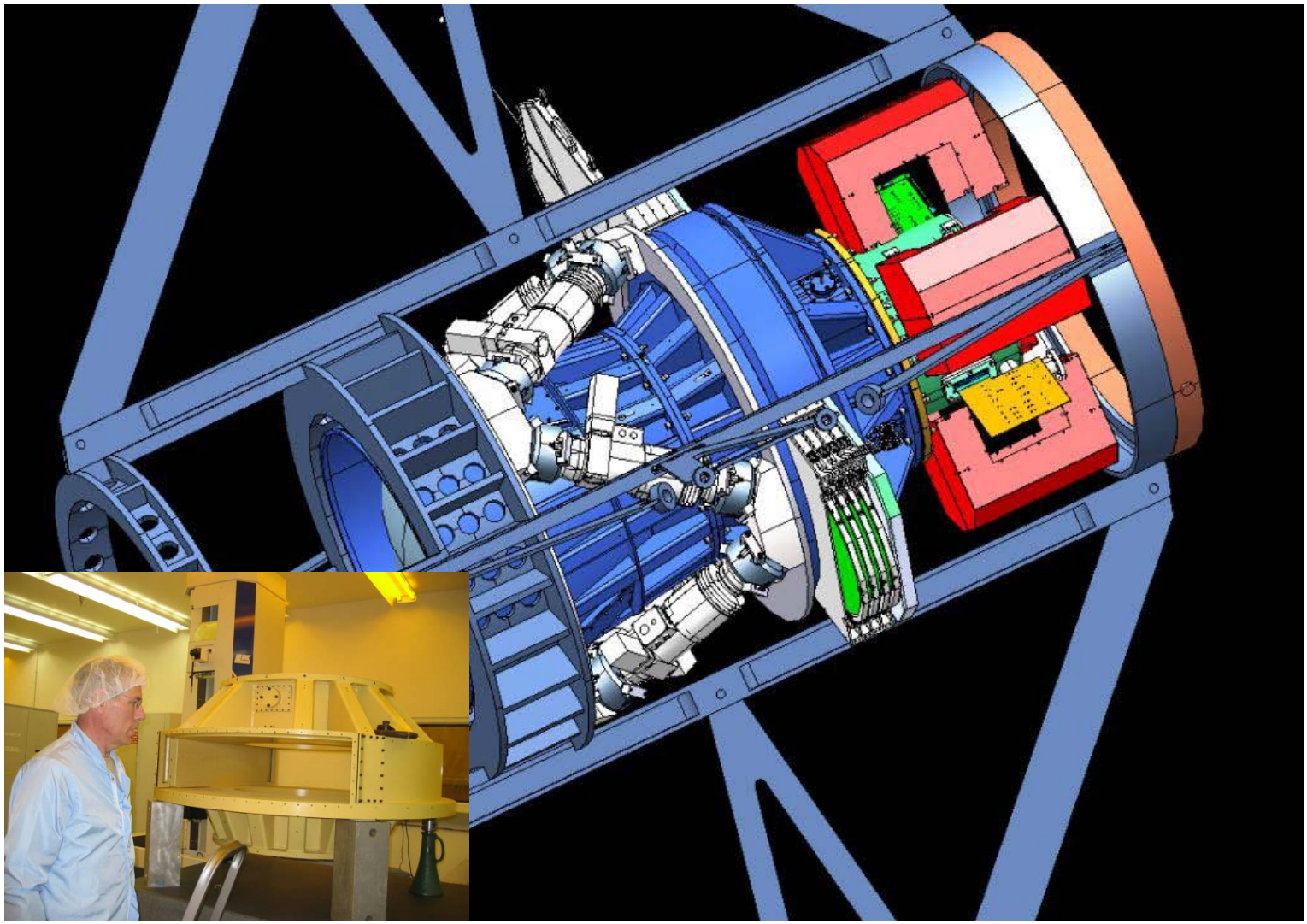
Ideas (DEIMOS)

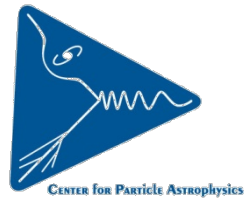
- Lusting after the Gemini South (8 meter) Telescope.
- Decouple the DECam imager and pop a 2kMOS onto the DECam barrel.
  - Normally a spectrometer has an “atmospheric dispersion corrector” to make all the light focus on one spot at one time.
  - Steve K says with no ADC we can focus all light λ>550nm into a 2” fiber. Not bad!
  - An ADC would fit into the large filter slot
  - We are thinking about other configurations.

Ideas (DEIMOS)

- Cost WAGs
  - Because we have a lot of assets already and don't need much R&D on detectors, electronics, and we know the telescope
  - Aim for $15M to $20M
    - $5M fiber positioner and fibers
    - Some optics (ADC and maybe a new C5)
    - Spectrometers
- Also, in parallel, low-noise CCD readout ~0.9 electrons (a record) and we expect to get a little lower.

DECam





Backup & Extra Slides

Big Boss

- Letter from Big Boss Collaboration in response to the AO

26 February 2010

Dr. Buell Jannuzi
Director
Kitt Peak National Observatory
950 N. Cherry Ave.
Tucson, AZ 85719

Dear Dr. Jannuzi,

We, the BigBOSS collaboration, declare our intent to respond to the National Optical Astronomy Observatory (NOAO) Announcement of Opportunity to partner with NOAO and the NSF to pursue a Large Science Program with the Mayall 4-meter telescope of the Kitt Peak National Observatory. We will propose a major new observing capability for the Mayall telescope – a prime-focus multi-object optical spectrograph capable of obtaining, in a single observation, moderate resolution spectra of 5000 targets spread over a field of approximately 3 degrees in diameter. We will use this instrument to undertake a large spectroscopic survey of the northern sky in order to place unique constraints on the nature of dark energy.

In what follows, we provide a brief description of our proposed instrument. An earlier version of this concept was submitted as a white paper to the Astro2010 Decadal Survey and is publicly available both at the Astro2010 web page and on astro-ph (http://xxx.lanl.gov/abs/0904.0468). The BigBOSS concept was presented to the Department of Energy PASAG committee in summer 2009, where it was endorsed.

Proposed Science Project

The BigBOSS survey will be a spectroscopic survey of 30 million objects over an area of 14,000 square degrees in the northern sky. These data will enable a Stage IV dark energy experiment designed to precisely measure the expansion history of the universe via the baryon acoustic oscillation (BAO) scale and redshift-space distortions.

BigBOSS will target luminous galaxies at $z<1$, emission-line galaxies at $z<1.7$ and QSOs at $z>2$. The galaxies directly trace the large scale distribution of matter while the QSOs will be used to accurately probe the distribution of gas at high-redshift using the Ly-α forest, building upon the pilot project currently in progress for SDSS-III. The BigBOSS survey will create an archive of lasting legacy value. These data will enable a wide range of investigations relating to galaxy evolution and cosmology.

Ernest Orlando Lawrence Berkeley National Laboratory
One Cyclotron Road | Berkeley, California 94720 | Tel: 510.486.5421 | Fax: 510.486.6003

Pages 2 & 3

The BigBOSS survey will require a minimum of 500 nights over a 5 year period on the Mayall telescope. Based upon the success and results of the northern survey (which we anticipate will run from 2016-2020), our collaboration will investigate the possibility of moving the BigBOSS instrument to the Blanco 4-m telescope at Cerro Tololo in order to complete an all-sky survey.

Instrument Concept

We will construct a large, fiber-fed, multi-object spectrograph for the prime focus of the Mayall telescope. In our baseline concept, we will develop a corrector for the prime focus to provide a telecentric field of view of 3 degrees in diameter, and equip the focal plane with a close-packed array of approximately 5000 computer-actuated fibers. The fiber positioners will be able to move the fibers on target accurately and rapidly, and a fiber-view camera will be built to verify their locations prior to each exposure. The fibers will feed a bank of 10 spectrographs, each capable of providing moderate resolution (R~5000) spectroscopy over a wide wavelength range (340-1060nm). We will build a very high throughput system capable of accurately measuring redshifts of emission-line galaxies to a minimum line flux of 2×10^{-17} ergs/cm^2/s.

Community Resources

The BigBOSS instrument will revolutionize the science grasp of the Mayall, and provide an unprecedented capability for the U.S. astronomical community. The community will have direct access to the instrument through the NOAO time allocation process, in addition to having access to the legacy archive produced by the survey. Observations beyond the primary survey could enable new Galactic and transient science, especially when coupled to the DES and LSST imaging programs.

We intend to provide an end-to-end observing system, including the software for fiber positioning, target acquisition, data acquisition, data reduction and archiving. The observing system will be available for use by NOAO to support its user community.

BigBOSS Collaboration

The BigBOSS Collaboration is an international partnership led by the Lawrence Berkeley National Laboratory (LBNL). Scientists from the following U.S. institutions are contributing to the development of the BigBOSS project: University of California at Berkeley, New York University, University of Michigan, University of Pittsburgh, University of Utah, and Yale University. In addition, BigBOSS has French participation from Laboratoire d'Astrophysique de Marseille (LAM), Centre de Physique des Particules de Marseille (CPPM) and Centre d'Etudes Nucleaires de Saclay (CEA), Chinese participation from Shanghai Astronomical Observatory and University of Science and Technology, and U.K. participation from a U.K. Participation Group. Our team brings a wide range of scientific, technical and managerial expertise from previous successful projects.

If our proposal is selected, we expect NOAO to be a full partner in this endeavor. We are in discussions with several other institutions, including Fermilab, and individuals from the U.S. astronomical community and anticipate the collaboration to grow.

Funding Model

If the BigBOSS proposal is selected by NOAO, our collaboration will seek funding from the U.S. Department of Energy, the National Science Foundation, and international partners. These are in addition to the support provided by NOAO and NSF in the operation of the Mayall facility. Institutional partners in BigBOSS are also expected to provide substantial resources to the collaboration in the form of in-kind or direct financial assistance as appropriate. Individual scientists participating in the project will be expected to contribute their time to aspects of the project relevant to their involvement, following a similar model to that of the DES and SDSS collaborations.

We look forward to working with NOAO and the NSF in enabling this unique capability for astronomy and physics.

Sincerely yours,

David Schlegel, Lawrence Berkeley National Lab
For the BigBOSS Collaboration

Endorsed by representatives of the BigBOSS collaboration:

Arjun Dey, National Optical Astronomy Observatory
Charles Baltay, Yale University
Michael Blanton, New York University
Adam Bolton, University of Utah
Zhai Chao and Tinggui Wang, University of Science and Technology of China
Anne Ealet, Centre de Physique des Particules de Marseille
Jean-Paul Kneib, Laboratoire d'Astrophysique de Marseille
Yipeng Jing, Shanghai Astronomical Observatory
Jeffrey Newman, University of Pittsburgh
Will Percival, University of Portsmouth
Greg Tarle, University of Michigan
Christophe Yeche, Commissariat à l'Energie Atomique, Saclay, IRFU

cc: David Silva, Director, National Optical Astronomy Observatory

NOAO –> B.B.

Buell T. Jannuzi, Director
Kitt Peak National Observatory
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Tucson, AZ 85726-6732
Ph: 520-318-8353
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jannuzi@noao.edu

National Optical Astronomy Observatory

Kitt Peak National Observatory • Cerro Tololo Inter-American Observatory • NOAO Gemini Science Center

March 30, 2010

Dr. David Schlegel
Lawrence Berkeley National Lab

Dear Dr. David Schlegel,

NOAO would be very pleased to receive a proposal from you and the BigBOSS collaboration along the lines detailed in your letter of intent of February 26, 2010. The deadline for receipt of your proposal will be October 1, 2010.

The current plan, supported by the AURA Observatory Council, is for the review of the proposal to take place in November of 2010 with a recommendation by the review panel to the NOAO Director shortly after the review. Your proposal is the only one being solicited under our current call for Large Science Programs for the Mayall 4m telescope of Kitt Peak National Observatory.

Your proposal should be sure to address/include the following:

- Your proposed large science project.
- The technical plan for performing the observations needed for the project.
- The complete concept for the new observing capability (i.e., instrumentation and software plans). The technical plan should present a conceptual design of the instrument in sufficient depth for peer reviewers to assess the feasibility of the project with the resources to be committed.
- A clear description of any modifications to the Mayall or enclosure or other mountain infrastructure necessary to enable the proposed new observing capability and your project.
- Provide evidence of adequate funding (or a viable plan to secure funding) for your project.
- A plan for the over-all management of both the capability development (instrumentation, software, etc.) and science projects. The management plan should outline how the optical-mechanical, focal plane, data acquisition, and data management work packages will be completed. A management plan including a work break down structure (WBS) and project schedule with conceptual, preliminary, and critical design reviews (or equivalent) should be included. The schedule should also include plans for the handling of acceptance testing and commissioning.
- The new instrument shall be delivered as part of a new observing capability, including the software and other tools necessary for researchers to use the instrument at its full potential and to process the data it produces to a state suitable for the production of scientific results. The proposal should address how these requirements will be met. If archiving the data products from the proposed large science program is a goal of the proposed project and to be viewed as a strength or benefit of the proposal, then the plans for how the data products will be archived and made available to the community should be addressed by the proposal. The quality of any proposed archive plan will then be considered during the review of the proposal. NOAO has special interest in projects that would produce coherent data sets of both immediate and lasting scientific value for the entire community.

If there are additional topics you feel should be addressed in your proposal in order to allow the review committee the most complete view of your plans, please feel encouraged to include such material in your proposal.

The review of the proposal will be conducted with a view toward balancing the availability of telescope time, the development of a major new observing capability for the general US astronomical community, and the delivery of a high-impact scientific result. You will be provided the opportunity to present your plans to the review panel and to answer their questions.

A proposal that clearly will have broad scientific impact, e.g., by enabling a high-demand instrumental capability, enabling science beyond the primary focus of those submitting the proposal, and/or by enabling significant participation by members of the U.S. astronomical community in the proposed key science program, would be preferred.

Please include a complete list of all institutions collaborating in the proposal.

While there is no page limit on the length of your proposal, it does not need to be longer than what is needed to adequately describe your plans and the items listed above.

You may include collaborators from NOAO in your team (e.g. Arjun Dey, but more could be added if you wish), but these individuals well be kept separate from the proposal review process.

We would appreciate receiving an electronic copy of the proposal.
If you have any questions please feel free to contact me.

Sincerely,

Buell T. Jannuzi, Director
Kitt Peak National Observatory

cc:
Dr. David Silva, Director, NOAO
Dr. Bob Blum, Deputy Director, NOAO

950 North Cherry Avenue • P.O. Box 26732, Tucson, Arizona 85726
www.noao.edu • Phone: 520.318.8000

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Big Boss

	BOSS (Stage III)	BigBOSS-North (Stage IV)	JDEM-BAO (Stage IV)	BigBOSS-N+S (Stage IV)
Redshift range	**0<z<0.7**	**0<z<3.5**	**0.7<z<2.0**	**0<z<3.5**
Sky Coverage	10000 deg^2	14000 deg^2	20000 deg^2	24000 deg^2
Wavelength Range	360-1000 nm	340-1130 nm	1100–2000 nm	340nm–1130 nm
Spectral Resolution	1600-2600	2300-6100	200	2300-6100
DETF FoM	57	175	250	286
DETF FoM w/Stage III	**107**	**240**	**313**	**338**

BigBOSS equivalent to JDEM satellite for mapping BAO

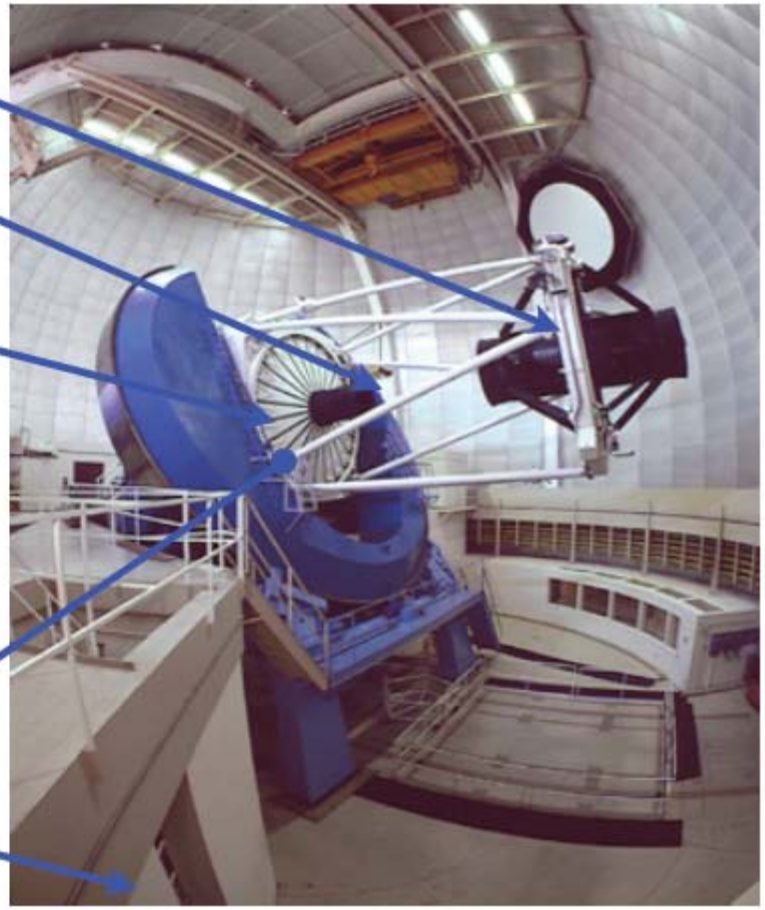
BigBOSS full-sky on KPNO 4m + CTIO 4m

- A little about scope of physics potential

D. Schlegel's talk 11/18/09

Big Boss

Kitt Peak 4-m (Mayall) at Kitt Peak, Arizona



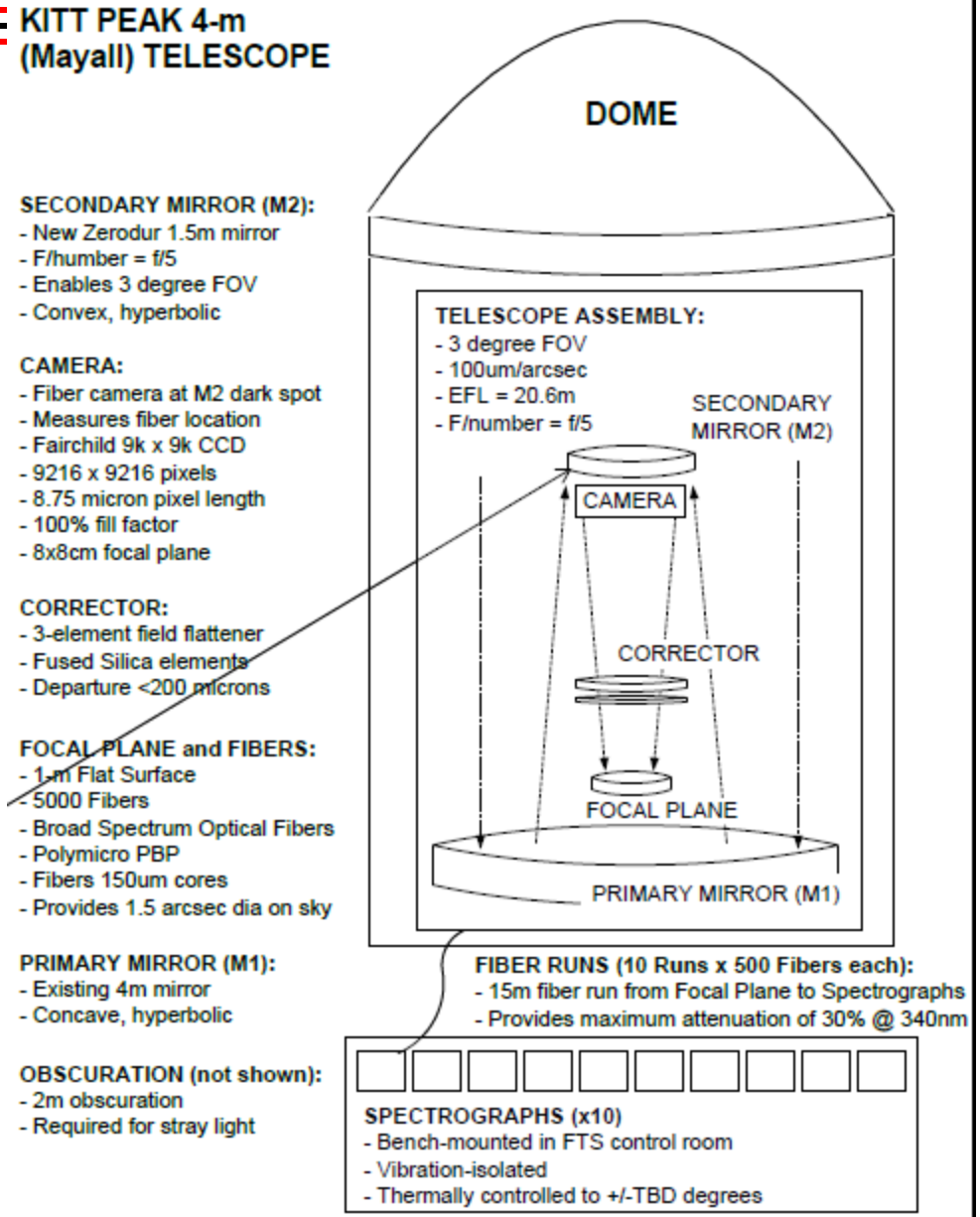
SDSS-inspired:
simple, high-throughput

D. Schlegel's talk 11/18/09

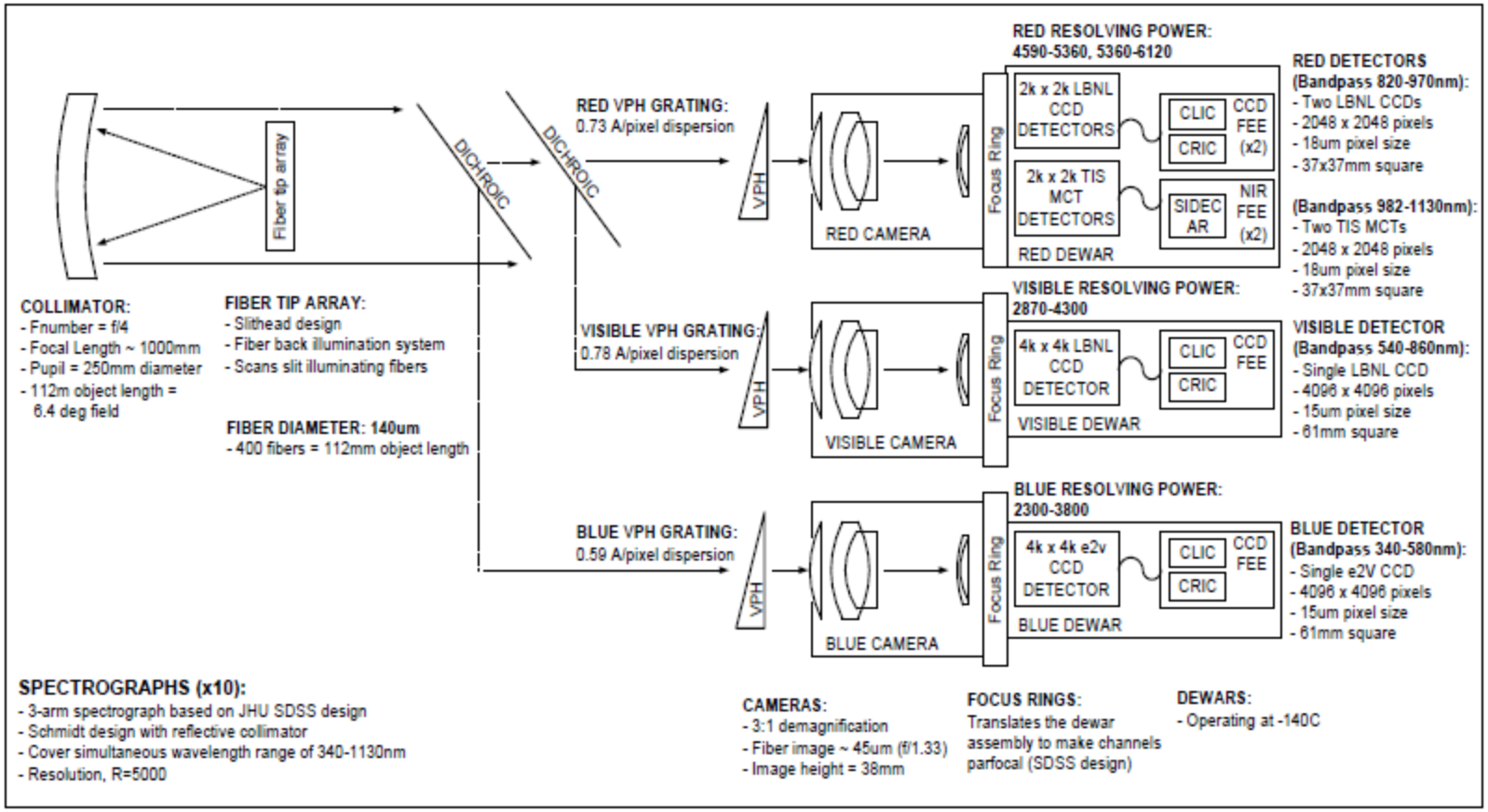
Big Boss Instrument

- A 1-meter wide focal plane with 5000+ controllable optical fibers

M. Levi's talk 11/18/09



Big Boss Instrument



Note: Here the CCDs are LBNL

M. Levi's talk 11/18/09

Summary

- LBNL was thinking about how to do a DETF Stage 4 BAO experiment from the ground. Their straw-man became called Big Boss.
- NOAO released an AO to provide a wide-field instrument for the Mayall
- LBNL contacted us about potential FNAL involvement in their idea. We have some potentially valuable experience from Dark Energy Survey and Dark Energy Camera

NOAO AO

NOAO announces an opportunity to partner with NOAO and the National Science Foundation to pursue a large science program with the Mayall 4-meter telescope on Kitt Peak and to develop a major observing capability (instrument, software, and archival plans) for the Mayall 4-meter telescope of the Kitt Peak National Observatory for the purpose of enabling large, high impact science programs and improving the capabilities provided as part of the U.S. System of ground-based optical and near-IR telescopes. Projects that use a diverse range of observing requirements (e.g. time of year, lunar phase, etc.) are encouraged. The dual goals of the large science program, as discussed in a recent edition of NOAO Currents are to enable frontier science and to improve the U.S. system of ground-based O/IR facilities. Although there are no restrictions on the type or scale of instrument, NOAO encourages proposals that will build on the Mayall telescope's strengths, utilizing its unique wide-field capabilities. NOAO has investigated potential wide-field options at both the Cassegrain and Prime foci, and these designs are available to aid those planning proposals.

In exchange for providing the community with a new observing capability for the Mayall, the NSF and NOAO will make available to the successful proposing team dedicated telescope time on the Mayall for their proposed science program. The capability provided by the team must enable frontier science to be carried out by the community, beyond the specific science program of the proposing team. The use of the new capability will be available to the general community through the normal NOAO TAC process during the time the large science program would be carried out and for several years beyond the completion of the proposed project. In the event that no Large Science Proposal meets these requirements, no proposal will be selected. Any selected program is anticipated to use up to 100 nights per year (e.g. the Dark Energy Survey, currently in development, will use the Blanco 4-meter telescope for approximately 100 nights per year for five years). A 500-night allocation on the Mayall represents a significant financial investment by the NSF (approximately $7 million dollars). A successful proposal team can expect to work with a team at NOAO providing technical and scientific expertise.

http://www.noao.edu/kpno/largescience.html

NOAO AO (2)

Letters of intent (LoI) expressing interest are required in order to assist NOAO in selecting members for the review committee and finalizing the proposal requirements. LoIs should be sent to Dr. Buell Jannuzi, Director, Kitt Peak National Observatory, jannuzi@noao.edu, by March 1, 2010. The LoI should outline the instrument concept, partnership, and proposed science project. Full proposals will be due on October 1, 2010. Proposals should describe in detail the proposed science project and observing capability (instrument, software, and archival plans), a clear description of any modifications that might be necessary to the Mayall, demonstration of adequate funding (or plan to secure funding), and project management plan. Detailed proposal instructions will be available no later than March 31, 2010.

Preference will be given to proposals that have a broad scientific impact, enable science opportunities for the US community of users, and/or enable significant participation by members of the US astronomical community. Proposed instruments should be consistent with a system-wide view of facilities available to the US community as described in the white paper, "NOAO and the O/IR System", the ReSTAR committee report, and other System development vision documents.

Potential proposers are encouraged to contact Buell Jannuzi at jannuzi@noao.edu.

Comments and advice from the community to NOAO regarding this call are also welcome and can be sent to Buell Jannuzi, who will share such submissions with NOAO Director David Silva and others managing this call for proposals.

LOI due March 1, 2010
Full Proposal due October 1, 2010

Big Boss @ PASAG

PASAG Recommendations

"The BigBOSS project proposes to greatly extend ground-based capabilities for galaxy redshift surveys by constructing a new 4000-fiber visible/NIR spectrograph for the existing NOAO Mayall 4-meter telescope in Arizona. With full-time use of the Mayall for 6 years, the BigBOSS spectrograph could acquire ~$10^{7.5}$ redshifts of galaxies at $0<z<2$ over 14,000 deg^2 of sky. An additional million quasar spectra could measure BAO features to $z<\sim3.5$ using intervening absorption systems. The survey could be extended to 24,000 square degrees with 4 additional years of full-time use of the Blanco telescope, a twin of the Mayall at NOAO's Chilean site. Galaxy redshifts will come primarily from the 373 nm [OII] line. BigBOSS can resolve this doublet for secure line identification, and the spectral resolution is high enough to enable the redshift-space distortion method as well. The BigBOSS concept has only been developed in the past year but has quickly built on experience with the SDSS and stage-III BOSS surveys.

"BigBOSS will require full-time use of NOAO 4-meter telescopes for a decade. These are important resources for the astronomical community so this is a major commitment. There is precedent: the stage-III Dark Energy Survey has been granted 1/3 of the Blanco time over 5 years. The BigBOSS survey will also require an extensive imaging survey to provide targeting information for its spectrograph. Clearly the BigBOSS project will require extensive cooperation with the astronomy community and agencies even if the construction and operations are fully funded by DOE.

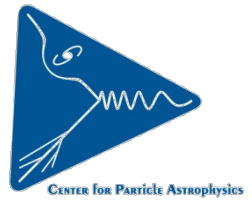
Big Boss @ PASAG

PASAG Recommendations

"Further R&D is needed to produce BigBOSS engineering and cost estimates as secure as those of LSST. The dark energy performance of BigBOSS can be more securely predicted than that of LSST because the BAO method is less likely than the SN and WL methods to be limited by hard-to-predict astrophysical and instrumental systematic errors.

"BigBOSS is in the early planning stages, but presents a legitimate possibility of achieving a significant fraction of the BAO science goals for JDEM at <$100M cost. Substantial immediate support is recommended for BigBOSS R&D so that ground BAO possibilities are known for timely planning of a coherent ground-space dark energy effort. The ground astronomy agencies (NSF/NOAO) are essential partners in the BigBOSS project and planning.

"A coherent overall strategy, optimizing observations both from the ground and space, taking into account the priorities of both the astronomy and physics communities, has been lacking. As described in Sections 1 and 6, PASAG is not constituted to do this. However, as dark energy is a very high scientific priority, PASAG sought to define the scope of dark energy within the broader particle astrophysics program. The detailed allocation to projects in the different budget scenarios awaits a coherent plan. The Astro2010 Survey, which is ongoing, will presumably play a key role in this planning.



Backup Backup & Extra Slides

Preliminary Project Organization

LBNL – Lead DoE Institution

- Construction Management - LBNL
- Spectrograph Optics - France
- Spectrograph Detectors & Electronics - LBNL
- Spectrograph Dewars - Yale & Others
- Fiber Positioner - China
- Fiber Control and FiberView Camera - Yale
- Focal Plane Mechanics & Guiding - LBNL
- Optics Assembly - NOAO, LBNL, Arizona
- Instrument Operations - Various
- Telescope Operations - NOAO
- Data Management - NYU
- Data Reduction - Utah

NOAO AO Blanco

Announcement of Opportunity for Blanco Instrumentation Partnership

NOAO announces a partnership opportunity to develop a major new instrument for the Blanco 4 meter telescope of Cerro Tololo Inter-American Observatory. Although there are no restrictions on the type of instrument that can be proposed, in order to build on the Blanco telescope's particular strengths we see a special opportunity to exploit the wide field capability of the prime or RC focus of the telescope. Additionally, any proposed instrument should be, consistent with a system-wide view of facilities available to the US community, in particular those in the southern hemisphere. Guidance on the US system can be obtained from the report on the first workshop on the ground-based O/IR system, see http://www.noao.edu/gateway/oir_workshop/

By the likely time of commissioning of the new instrument solicited here, we expect to have retired the RC and Echelle spectrographs since their capabilities will have been replaced by new instrumentation on SOAR and Gemini. We plan to begin sharing the wide-field IR imager NEWFIRM with the KPNO Mayall 4-m in 2006, NEWFIRM is described at http://www.noao.edu/ets/newfirm/. A technical description of the telescope will be accumulated here.

Proposers will need to submit a science plan, a technical plan, and a management plan. The science plan should include a description of compelling science to be undertaken by the proposing team, which may be in partnership with NOAO, and also an outline of anticipated astronomy community use of the instrument through merit based proposals. The technical plan should present a conceptual design of the instrument in sufficient depth for peer reviewers to assess the feasibility of the project with the resources to be committed. The management plan should outline the proposed sharing of responsibilities for optomechanical, focal plane, data acquisition, and data management work packages between the proposer and NOAO. A general management structure along with a schedule of project reviews (PDR, CDR) and acceptance testing should be included. The management plan should include a plan for public and educational outreach and explain the broader impacts of the project.

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Up to 30% of the Blanco telescope time for 5 years commencing in 2007 or 2008 is available for the science project. NOAO will contribute the operation of the telescope and an upgraded control system with a combined nominal annual value of $4M at real year prices. NOAO would expect to partner with the successful proposer in developing a data management system, (including data acquisition) which is compatible with the National Virtual Observatory. The successful proposer can expect to work with an engineering interface at NOAO with optomechanical and other expertise.

Letters of intent are due at NOAO on March 15, 2004. At that time an NOAO contact person will be appointed to answer proposers' technical inquiries, and to give guidance on the form and scope of the proposal. Instructions and technical information will also be available via these WWW pages, and arrangements can be made for early appointment of the NOAO contact person, mentioned above, if appropriate. Full proposals are due August 15, 2004, and will be reviewed by an expert external panel. It is expected that results will be announced by October 15, 2004.

Potential proposers are encouraged to contact Alistair Walker at awalker@ctio.noao.edu , (56-51-205200).

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http://www.ctio.noao.edu/telescopes/TheFuture/Blanco_prop.html

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