



Briefing to STUC

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Topics

- Restoration of ACS High Resolution Channel
- SM4 Decision
- Relative SM4 priorities of COS and WFC3
- Post-SM4 Operations

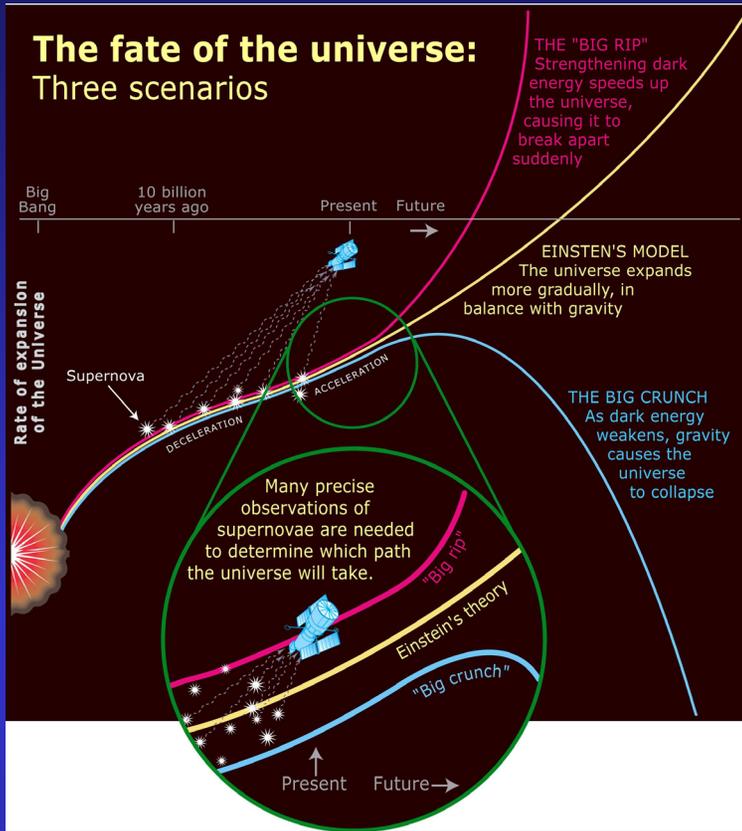
Restoration of ACS/HRC

- **Resumed ACS Wide Field Channel operation October 1 following September 23 suspend event. Restored High Resolution Channel capability on October 10 on first attempt to toggle the suspect relay**
- **Problem apparently was small piece of debris blocking electrical contact in the relay used to switch from SBC to HRC**
- **Problem previously encountered with same relay in other missions**
- **Painstaking analyses and ground testing assured safety of attempting relay cycling**
 - “Best of the best” GSFC Electrical, Parts and Quality Assurance Engineers spent days, nights and weekends assessing the cause of the problem and developing procedure for resolving it
 - Four or five levels of safety assured the safety of cycling the relay
- **ACS team expressed general concerns, recommended delaying relay cycling, pressing on in a WFC science-only mode**
- **Project scientist position**
 - Risks of test were vanishingly small
 - Likelihood of full recovery was high, given experience on other missions
 - Didn’t want to place ACS deeper into a “death spiral” following failure of Side 1 electronics
- **Relay cycling was approved by GSFC Engineering Directorate, Quality Assurance Directorate, Center Top Management, STSci Top Management, SMD Top Management, and NASA Administrator was informed**
- **Follow up ground testing performed at Ball to determine if prior assumptions about CCD camera redundancy are valid**

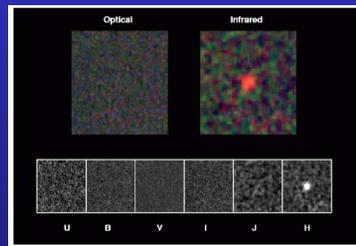
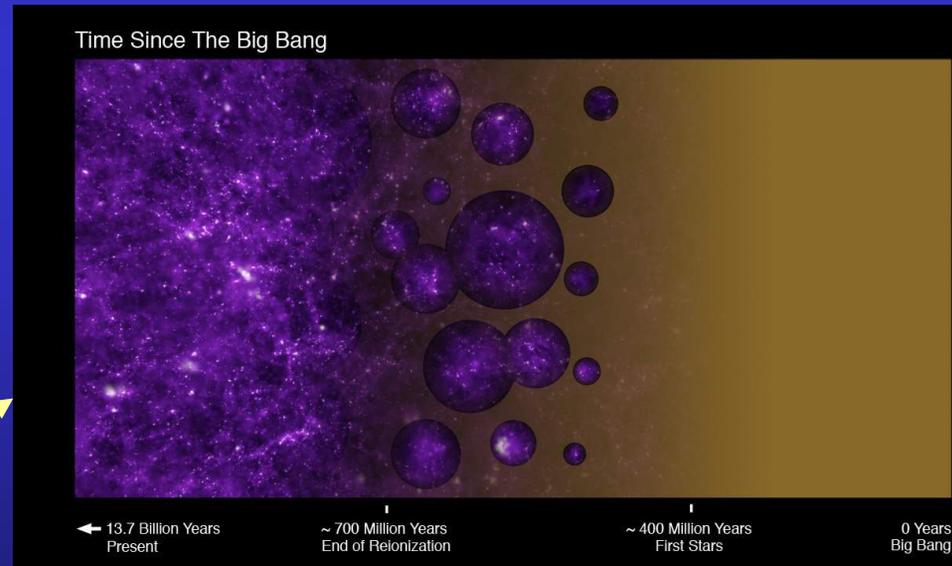
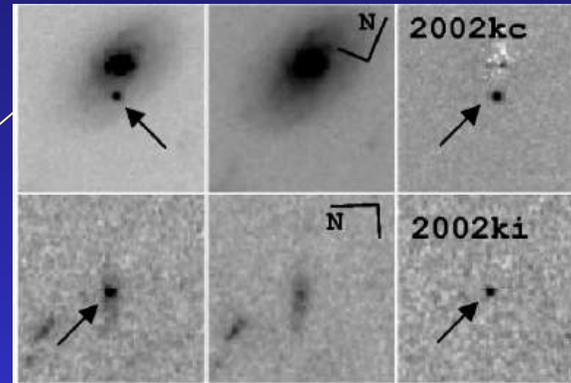
WHY SM4?

- **The Bottom Line: We haven't yet approached the limits of what Hubble can do; SM4 will give us at least 5 more years of amazing science**
- **At the conclusion of SM4 Hubble will be at its scientific apex**
 - **First time it will have 6 operating instruments since 1993**
 - **WFC3 and COS provide factors of >10 improvements over their predecessors**
 - **Restores robust capability for space-based astrophysical spectroscopy**
- **As a 'general purpose' observatory, Hubble provides diverse and powerful tools to attack problems at the frontiers of most areas of astronomy**
- **User demand for Hubble time continues unabated**
 - **Currently 5:1 oversubscription**
- **Scientific productivity continues to grow, outpacing all other astronomical facilities**
 - **Peer reviewed publications now exceed 650 per year**
- **Hubble continues to inspire the public – a national icon and source of pride**

WFC3+ACS = Most Powerful Imaging Ever



Supernova surveys over large interval of look-back time to characterize dark energy



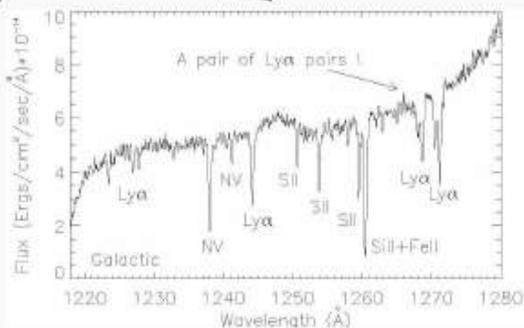
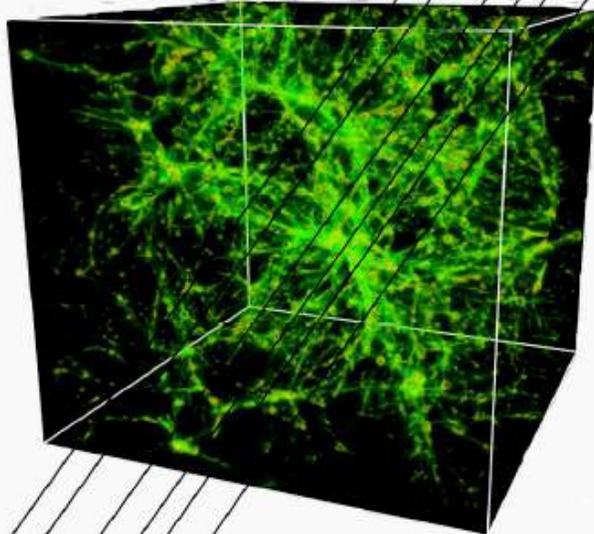
Extend Hubble Ultra-Deep Field to near-infrared
Probe more deeply into epoch of re-ionization – blaze trail for JWST



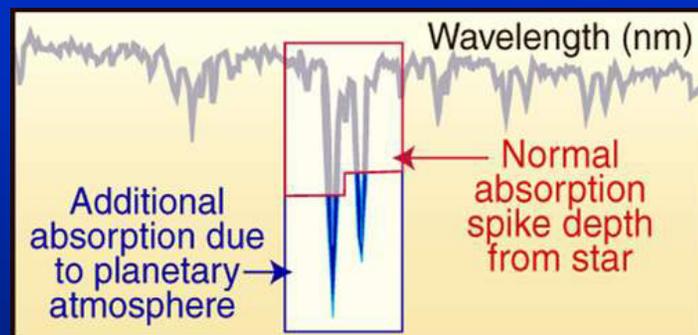
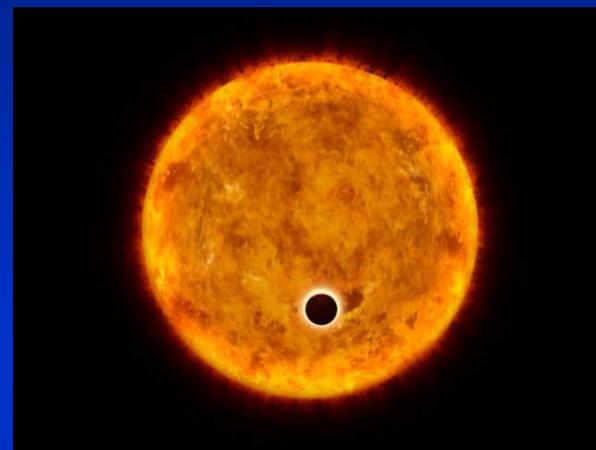
COS+STIS = Full set of tools for astrophysics

COS will trace the large-scale structure and evolution of matter across the universe

Quasar absorption lines trace the “cosmic web” of material between the galaxies



STIS will increase the number of detected exo-planetary atmospheres from 1 to ~10



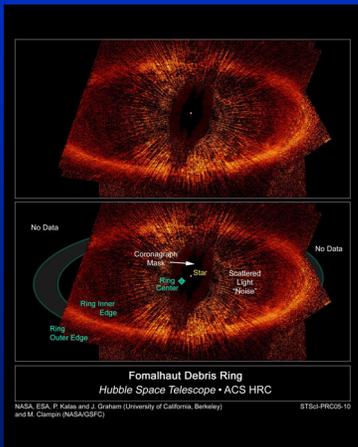
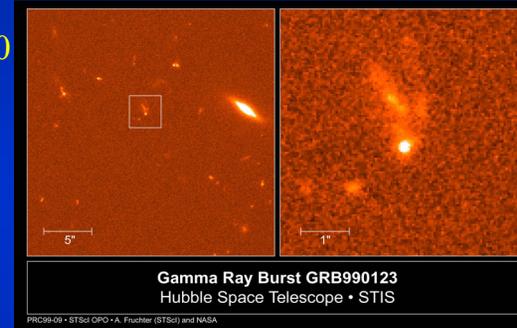
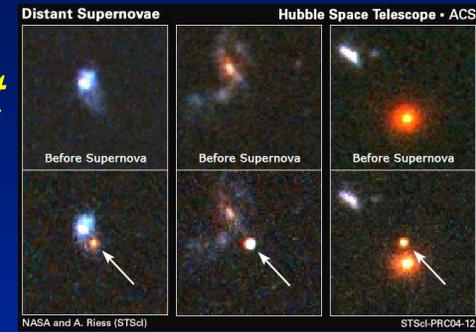
Na I D lines, 589 nm



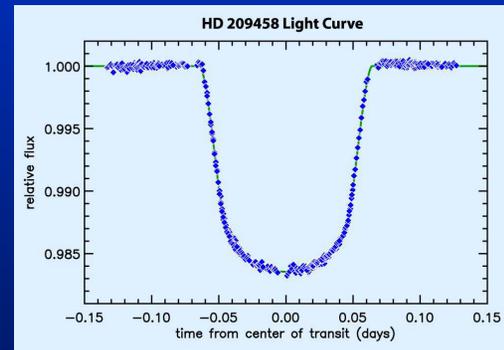
Many areas of high-impact Hubble science were unanticipated

- Pre-1990 objectives
- Unexpected achievements

- Creation of galaxies (HDF, UDF)
- Acceleration of Universe: SN Ia
- Distance scale of the Universe: H_0
- Giant black holes in galaxies
- Emission lines in active galaxies
- Intergalactic medium (QAL)
- Interstellar medium chemistry
- Gamma Ray Burst sources
- Protoplanetary disks
- Extrasolar planets

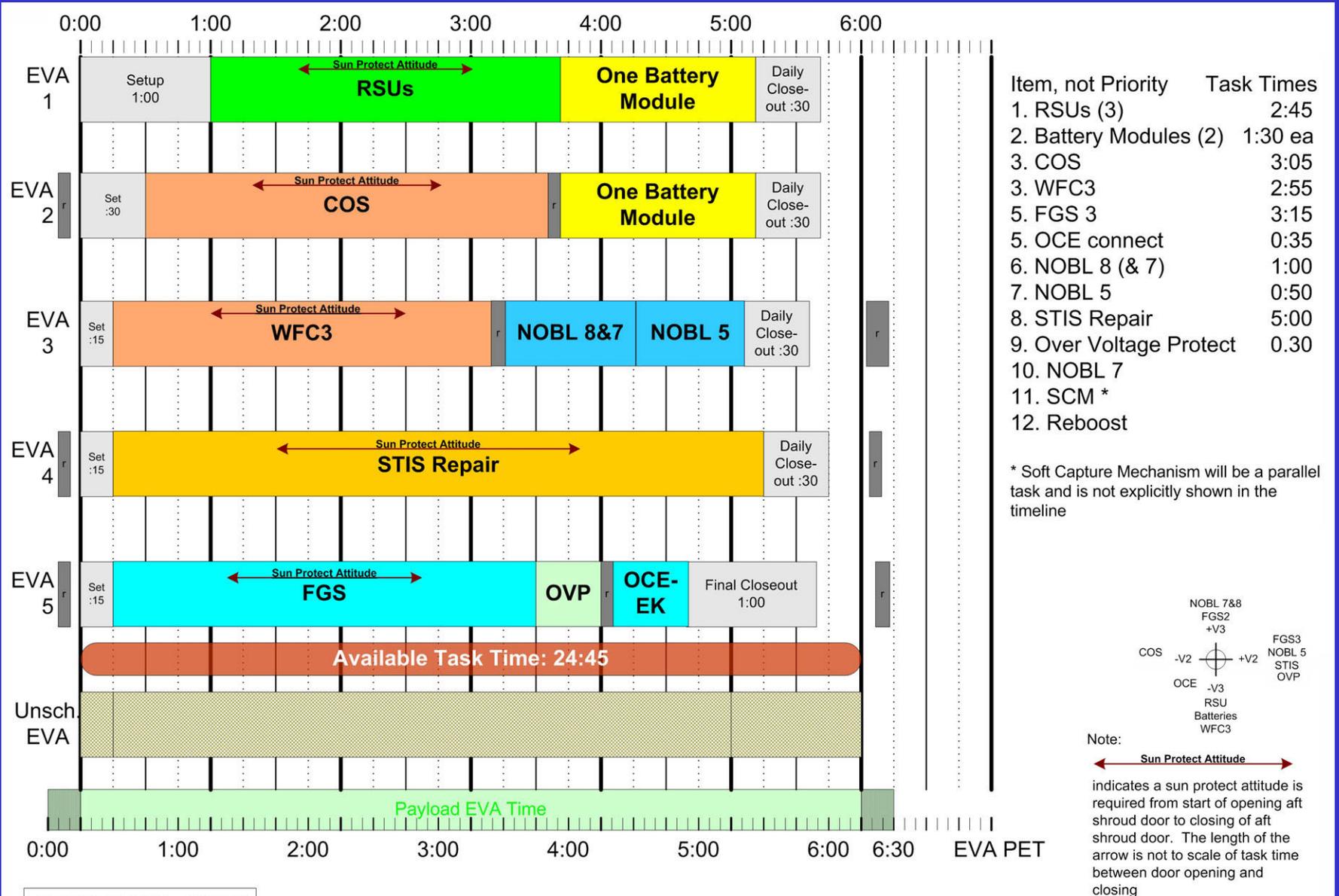


At its scientific apex after SM4, Hubble will continue to astonish us with the unexpected!



For HST Program Planning Purposes Only

SM-4 EVA Scenario

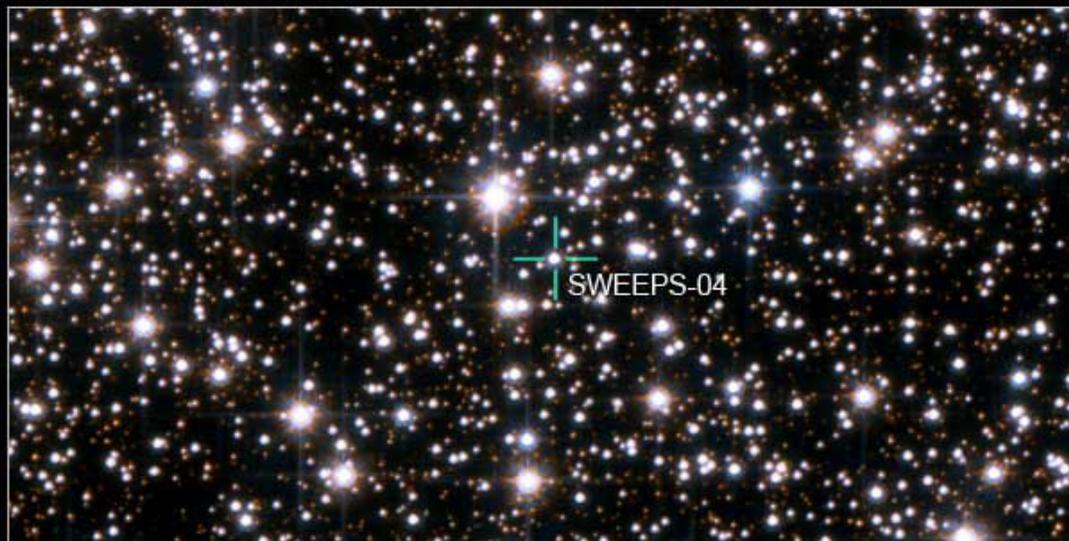


Relative Priorities of COS and WFC3

- **Priorities will need to be set as part of overall prioritization process**
- **Once EVA's begin it is highly probable that both instruments will make into HST**
 - Prioritization is a formality that guides both pre-mission contingency planning and real-time responses to in-orbit emergencies (very low probability)
 - It is a painful, divisive process that hopefully will have no use in the end, but it must be done
- **Priorities may change with time and unfolding events**
 - Loss of redundancy on ACS influences priority of WFC3 because of threat to overall imaging capability of Hubble
 - Loss of STIS influences priority of COS; there currently is no UV spectroscopic capability in space other than FUSE
 - Possibility of restoring STIS can't *a priori* influence priority of COS since contingency decisions would likely have to be made prior to attempt at STIS repair and STIS repair is uncertain.
- **Priorities should be driven by science – the most compelling science should have highest priority**
- **This is a scientific “Sophie’s Choice”**
- **STUC’s inputs on this question are solicited as part of the bigger process**
 - Would like recommendation and supporting rationale by next Spring

Post-SM4 Operations

- **STUC ACTION ITEM:** “Post-SM4 there will be 6 instruments in the HST focal plane. The STUC would like to hear about how STScI plans to cope with these observational riches, and how instruments should be prioritized in a time of tight budgets. We suggest that this issue could be the topic of a major review (e.g 1 day) at the next STUC meeting. A primer on quasi-duplicative modes among instruments and usage levels of modes would be informative. We are happy to defer or minimize some of the more routine presentations in order to accommodate this review in the STUC agenda”.
- **PROJECT POSITION:**
 - **The investment in SM4 is high, including risking astronaut’s lives. After SM4 we want to realize a high return on this investment. It is not our intent to cut corners on post-SM4 operations**
 - **Assume a steady level of support; internal priorities can be adjusted if needed to assure high scientific productivity**
 - **Matrix of supported instrument modes should be driven by what makes the most scientific sense**



Sagittarius Window Eclipsing Extrasolar Planet Search
Hubble Space Telescope • ACS/WFC

