CANADIAN PARTICIPATION IN WFIRST

Mike Hudson
U Waterloo - Canadian rep on WFIRST SDT
Recommendation:

“… Canadian astronomers participate in a major wide-field Dark Energy satellite mission. Joining Euclid or WFIRST as a significant partner would fulfill this recommendation, provided that we can (i) negotiate a partnership in the leading mission, and (ii) identify a contribution to the satellite instrumentation.”

“… Euclid/WFIRST has emerged as the LRP2010 panel’s top space priority.”
WIDE-FIELD IMAGING IN CANADA

- CFHT Megacam surveys are current state-of-the-art
  - Deep: SNe (SNLS: e.g. Sullivan et al. 11, Conley et al. 11)
  - Wide: Lensing
The combined constraints are thus consistent with a flat energy density parameter of the same order. The joint CFHTLenS and WMAP results indicate a slightly smaller value of $\Omega_m^0$ compared to other 3D tomographic weak lensing methods.

The case of dark energy is similar in the curved case. CFHTLenS helps to improve the constraint on the curvature density parameter $\Omega_k^0$ by a factor of 4.

Adding the R09 prior on the Hubble constant, however, shows a similar dependency on $\Omega_m^0$ and $\Omega_k^0$. In combination with WMAP 7 alone, these parameters are of the order of 8 per cent for the flat case.

For a CDM value, the uncertainty decreases by a factor of 10 from $\Omega_m^0 = 0.73$ to $\Omega_m^0 = 0.68$ for the flat case. This is in contrast with 3D tomographic weak lensing. The CDM case, the degeneracy of $\Omega_m^0$ and $\Omega_k^0$ increases. On the other hand, adding CFHTLenS alone results in an improvement on the mean of $\Omega_m^0$ to 30 per cent.

The 5.2.2 Curved model case. Therefore, the improvement on the mean of $\Omega_m^0$ can be determined to within the error bars.

For the following results on the dark-energy equation-of-state parameter $w$, we use the flat prior $[w = -1]$ with respect to the flat prior with a reference low value, $w = -1.14$.
ACKNOWLEDGMENTS

The population of blue galaxies does not evolve strongly in the SHMR as well. Little evolution in blue galaxies with cosmic time. The population of blue galaxies does not evolve strongly in the SHMR as well. Little evolution in blue galaxies with cosmic time.

Figure 15. Notice that blue galaxies evolve to lower stellar masses with time. This result is formally statistically significant at the 99.99% confidence level for our parameterization in the peak halo mass detected between redshifts $z=0$ and $z=1$.

The SHMR data compared to a model in which star formation follows the Hubble law, consistent with that expected from pure dark matter accretion. The main conclusions from pure dark matter accretion are heretofore possible with weak lensing. The main conclusions from pure dark matter accretion are heretofore possible with weak lensing.

GALAXY-GALAXY LENSING: CO-EVOLUTION OF STELLAR AND DARK MATTER MASS

WFIRST: ~100x more bins!

MH et al 1310.6784, in press
EXOPLANETS

Marois et al 2006, 2008 + GPI
CANADIAN SPACE AGENCY AND ASTRONOMY

• Launched missions joint with NASA, ESA

  • FUSE

  • Herschel/HIFI (U. Waterloo)

  • Planck

• Current with JAXA

  • Astro-H
CANADIAN SPACE AGENCY
AND ASTRONOMY

JWST

• ~$150 M from CSA

• Fine Guidance Sensor

• Near-Infrared Imager and Slitless Spectrograph (NIRISS)

• PIs: Hutchings (NRC) and Doyon (U Montreal)

• Both built by COM DEV
Proposed: CASTOR Design and Specifications

- **Telescope**
  - three mirror anastigmat
  - unobscured aperture = 1m

- **Focal Plane**
  - 45 4k × 4k H4RG with 10μm pitch
  - FWHM = 0.15"
  - field of view = 1.02° × 0.57°
  - three filter imaging
    - 400-550 nm (g)
    - 300-400 nm (u)
    - 150-300 nm (UV)

- **Orbit**
  - 600-1000 km
  - sun synchronous low Earth orbit

- **Mechanical Design**
  - customized MAC-200 SmallSAT bus
  - payload mass = 572 kg
  - spacecraft mass = 1320 kg

- **Operation Mode**
  - nominal 5-year lifetime
  - legacy surveys ⇒ GO programs

See P. Cote or poster 6
Sensitivity and Wavelength Coverage

EE50 radius in arcseconds
WFIRST STATUS IN CANADA

CSA has launched two studies to examine instrument options for:

- WFI
  - IFU/slicer
  - Calibration
  - Guidance
  - Data and software

- Coronograph
  - IFS
  - EMCCD
  - Analysis software
The Hubble Ultra Deep Field
seeing the Universe, 10,000 galaxies at a time

WFIRST-AFTA: Hubble x 100

A WFIRST-AFTA Deep Field
A New Window on the Universe - 1,000,000 galaxies at a time
WFIRST IN CANADA

• CSA has launched two studies to examine instrument options:
  
  • Due date: approx 6 months

• Strong response from the Canadian astronomical community to participate in these studies

• Long Range Plan Mid-Term Review final report due Fall 2015