Summary of MSSL/UCL Cosmology

Tom Kitching & Mark Cropper

- MSSL cosmology

  - Cropper head of the Astrophysics group

  - Kitching recently hired
  - New Cosmology lectureship advertised now

  - Strong involvement in Euclid mission

  - As part of new injection of people our wish is build strong and permanent links with other London Cosmology groups through existing collaboration and through new ventures

- Astrophysics Group members:
- 7 HEFCE-funded staff:
  - Branduardi-Raymont, Cropper, Ferreras, Kawata, Page, Wu, Zane, Kitching (12 Nov)
  - and new hire (1 Apr 2013) in Cosmology
- 4 STFC-funded research postdocs:
  - Mehdipour, Mignani, Pasetto, Symeonidis
- 6 UK Space Agency-funded `mission-orientated' science postdocs:
  - Breeveld, Kuin, Niemi, Oates, Seabroke, Yershov
- 10 PhD students
  - Barnes, de Bokx, González, Grand, Hunt, Hutton, Jacobsen, On, Rawlings, Younsi
  - Just completed: Pickard, Rahimi, Mehdipour

- Main Scientific Fields:
- Compact Objects
  - neutron stars
  - gamma-ray bursts
  - black holes (supermassive)
- Galaxy Evolution
  - star formation history and black hole growth in UV, optical and Infrared
  - galaxy structure, galaxy modelling
  - Radiation Transfer Theory
  - polarised transfer in highly gravitationally curved regimes (photons, neutrinos)
- Cosmology
  - Origin and evolution of cosmological magnetic fields
  - Nature of Dark Energy and Dark Matter

- Science is underpinned with strong links to space inst
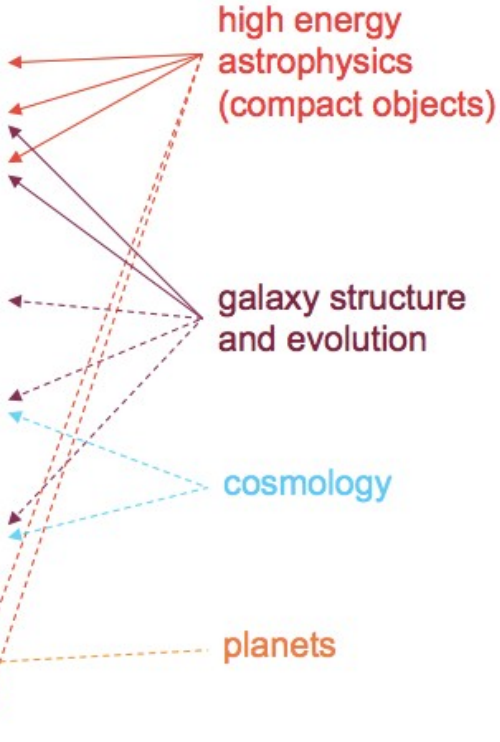
MSSL Astro Missions | ESA | NASA

- Operating missions:
  - XMM-Newton (OM and RGS) [1999]
  - Swift (UVOT) [2004]
  - Herschel (SPIRE) [2009]
- Awaiting launch:
  - Gaia (RVS) [2013]
  - James Webb Space Telescope (NIRSpec) [2018]
- Under Development
  - Euclid (VIS) [2020]
- Proposed:
  - M3   LOFT or Echo ? [2021]
  - L1   Athena ? [202?]

high energy astrophysics (compact objects)

galaxy structure and evolution

cosmology

planets

Euclid

- Euclid Weak Lensing major focus of cosmology group long term (next ~15 years) now to 2025-2030 (data and post-mission)

- MSSL leads both
  - the Instrument for weak lensing (VIS; Cropper) and Instrument

- UCL-MSSL lead of the 2nd-largest imager in space

- Will be the most powerful facility available to study dark energy and dark matter
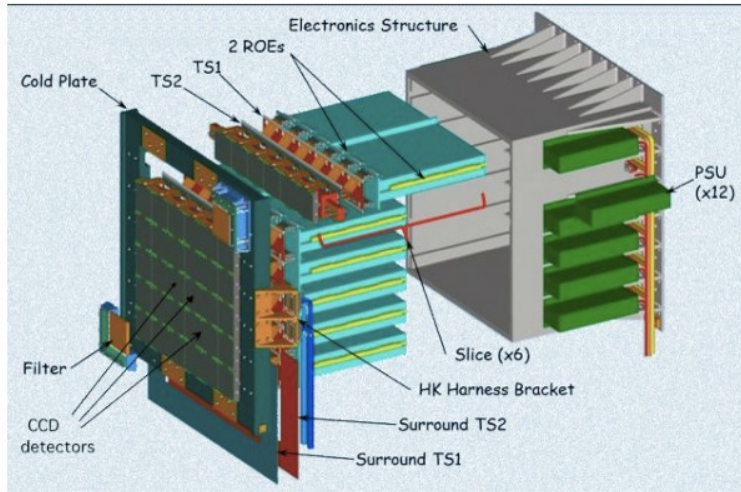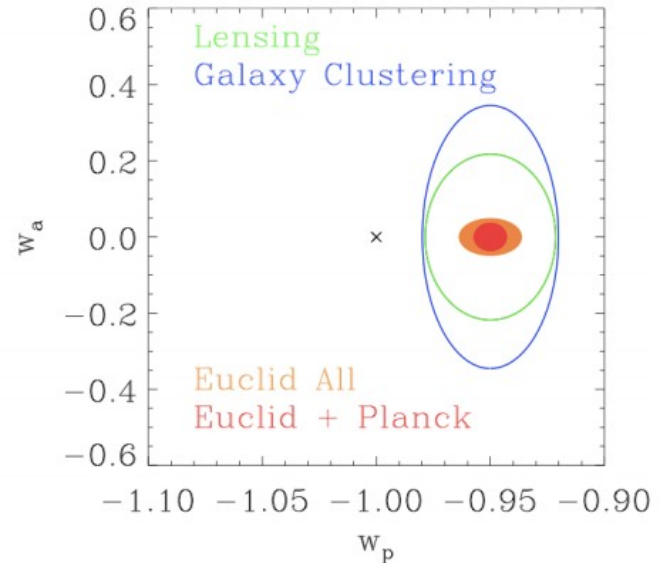
DE constraints from Euclid: 68% confidence contours in the (w_p, w_a).

- Kitching
  - Royal Society URF
  - Science: co-developed 3D Weak Lensing methodology
    - Strong links with Imperial (Heavens)
    - Application to data for the first time (CFHTLenS)
  - AstroStats & AstroInformatics methods
    - Evidence based methodologies and path integral methods
  - Image Analysis
    - Developed most sophisticated and widely used weak lensing image analysis tool
    - Lead largest simulation effort to date (GREAT10 and Mapping Dark Matter)
    - Strong links with UCL P&A in this area
- Project involvement
  - Cosmology and Weak Lensing co-coordinator for Euclid
  - Core team of CFHTLenS
  - Data Analysis Verification for Pan-STARRS-1 (data still being acquired)
  - Strong involvement and member of KiDS

Synergy

- **Medium term (5-8 years)**
  - A clear science link = weak lensing approaches
    - Kitching, Heavens, Lahav, Abdalla
    - Shared studentships/postdocs would be very fruitful
  - Survey Data Analysis & Calibration
    - LCDM is a unique group that contains expertise working on all DES, KiDS, Pan-STARRS
    - Surveys overlap and there is potential synergy in systematic cross-checks at least
  - Computation for Simulations (a common problem)
    - For Euclid (and even KiDS/DES) will likely need 104 to 106 Millennium size simulations
    - Huge undertaking, needs coordinated effort
    - Also possible mitigation at theoretical/estimators-level (data compression; shrinkage)

- **Longer Term (Euclid-era)**
  - Existing Euclid structures already will promote collaboration (most, or all (?), are in Euclid?)
    - Kitching (WLSWG lead), Abdalla (OULE3 dep.), Cropper (VIS), Warren (Legacy lead)
  - Regular LCDM-Euclid meetings may be common ground with collective focus?