UK SKA Status update

Mark Sargent
(U. of Sussex)

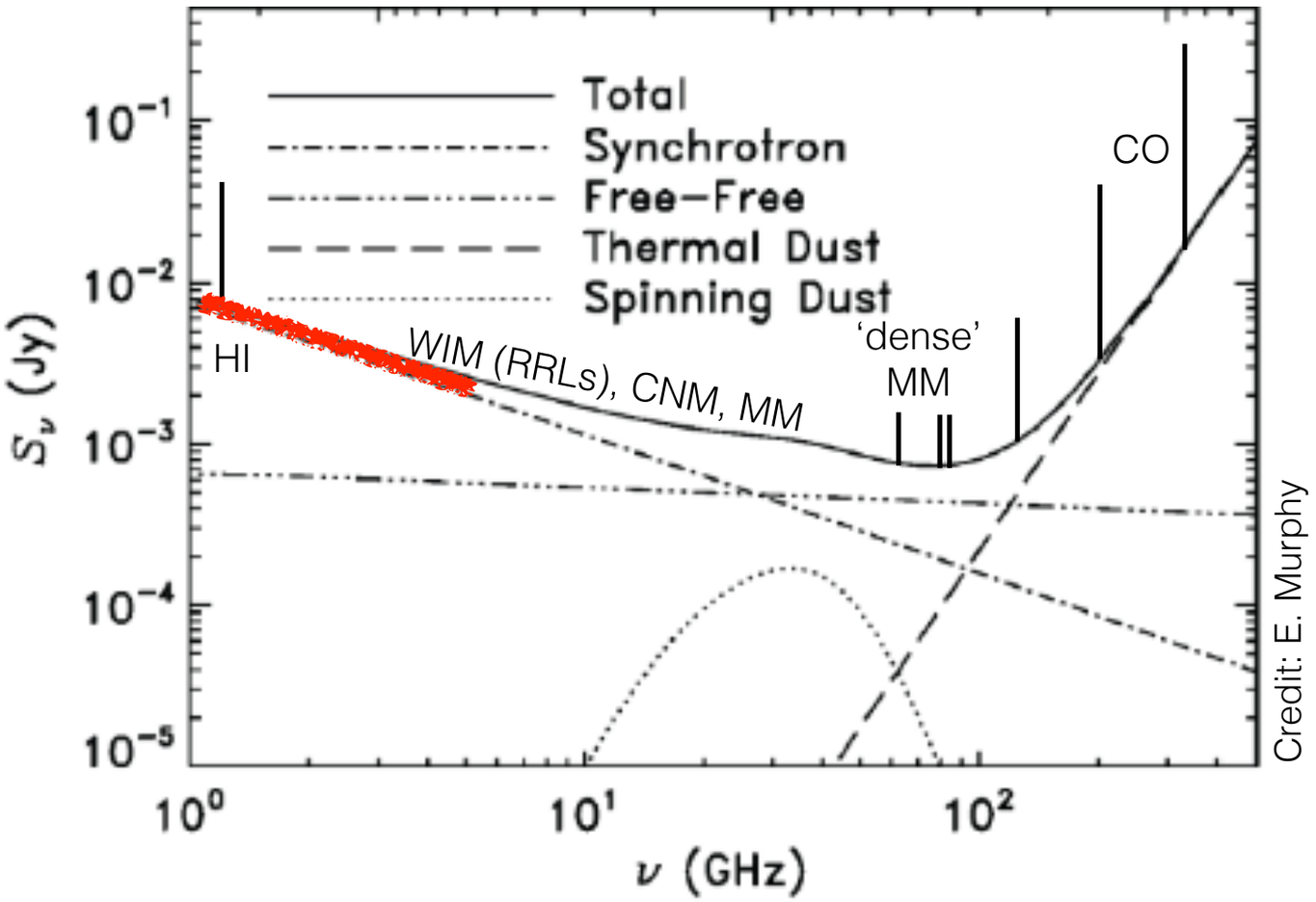
w/ contributions from P. Best, STFC, UKSKASC & RASR 2017 panelists

UNIVERSITY OF SUSSEX

Image credit: ESA

SKA, the synchrotron continuum SFR machine

Sub-mm - mm spectrum of a star-forming galaxy:



SFR ~ $10^{q_{IR}}$ $L_{1.4}$

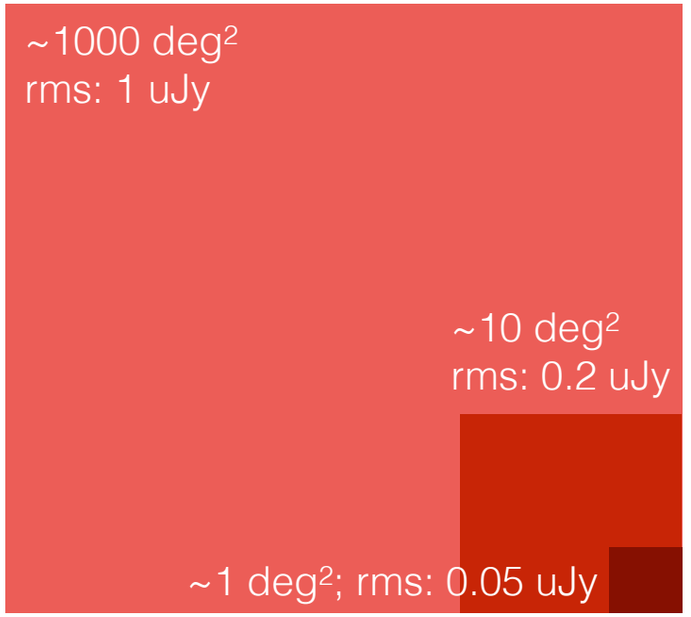
(q_{IR} ~ log[$L_{IR}/L_{1.4}$])

Continuum SWG reference survey (SKAO HPSO #37):

"***Non-thermal SFR processes & AGN/galaxy co-evolution***"

band 2, ≲0.5" resolution

duration: ~2 years

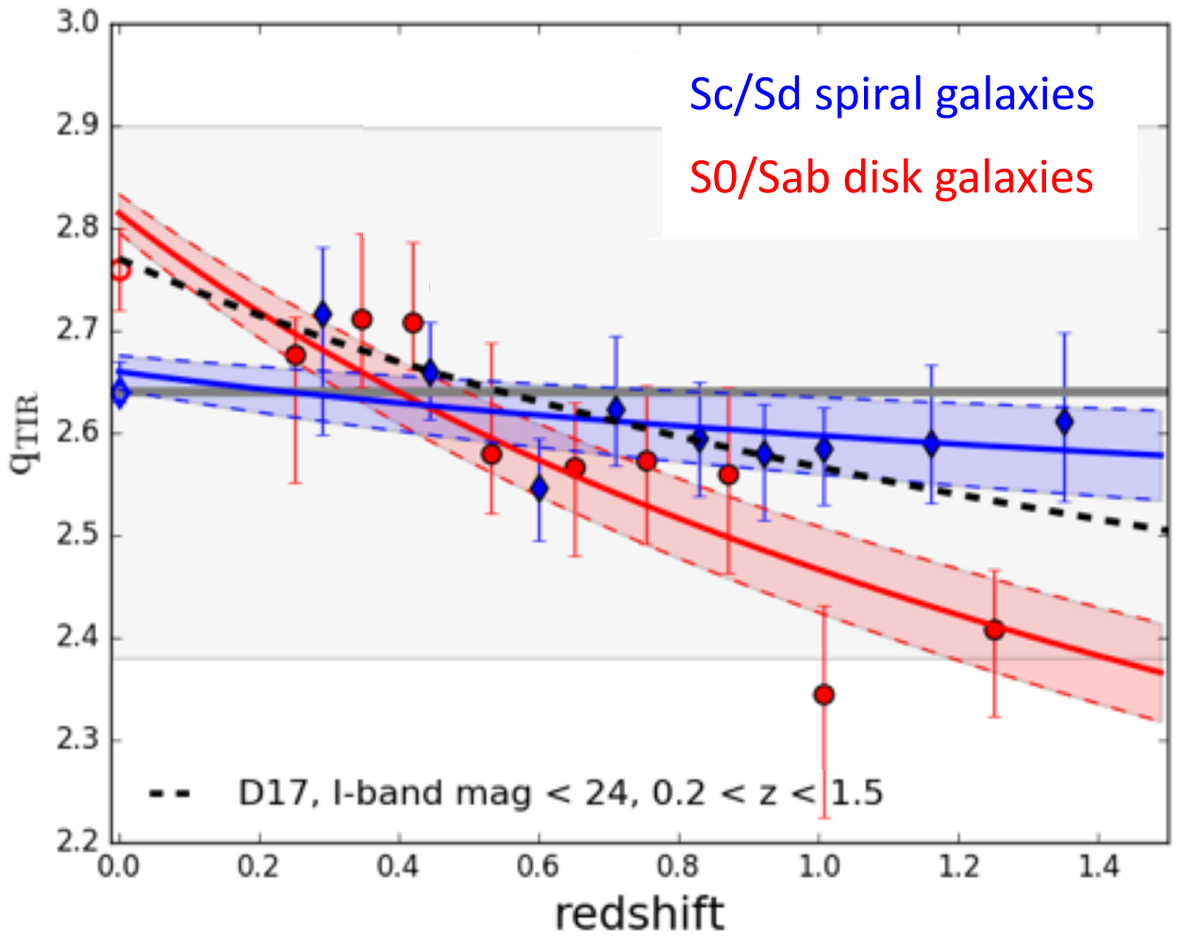


SKA, the synchrotron continuum SFR machine

Daniel Molnár (U. of Sussex ➠INAF Cagliari)
PhD projects

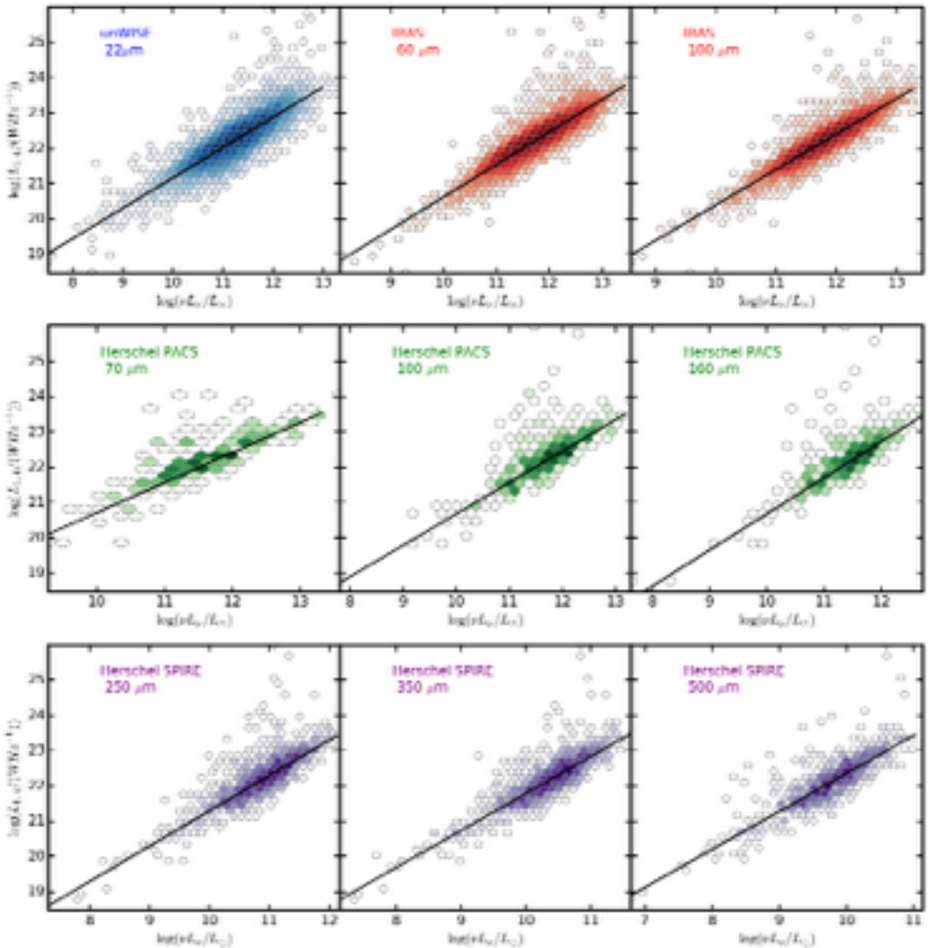
Different redshift-evolution of IR-radio relation depending on galaxy type (Molnár+, 2018):

In galaxy disks, radio synch. luminosity traces SFR in the same way for 9.5 Gyr of look-back time.



The z~0 IR-radio relation using >10k SDSS galaxies (Molnár+, in prep.):

A multi-variate investigation of the scatter of the $L_{1.4}$ vs. SFR relation and its selection biases.

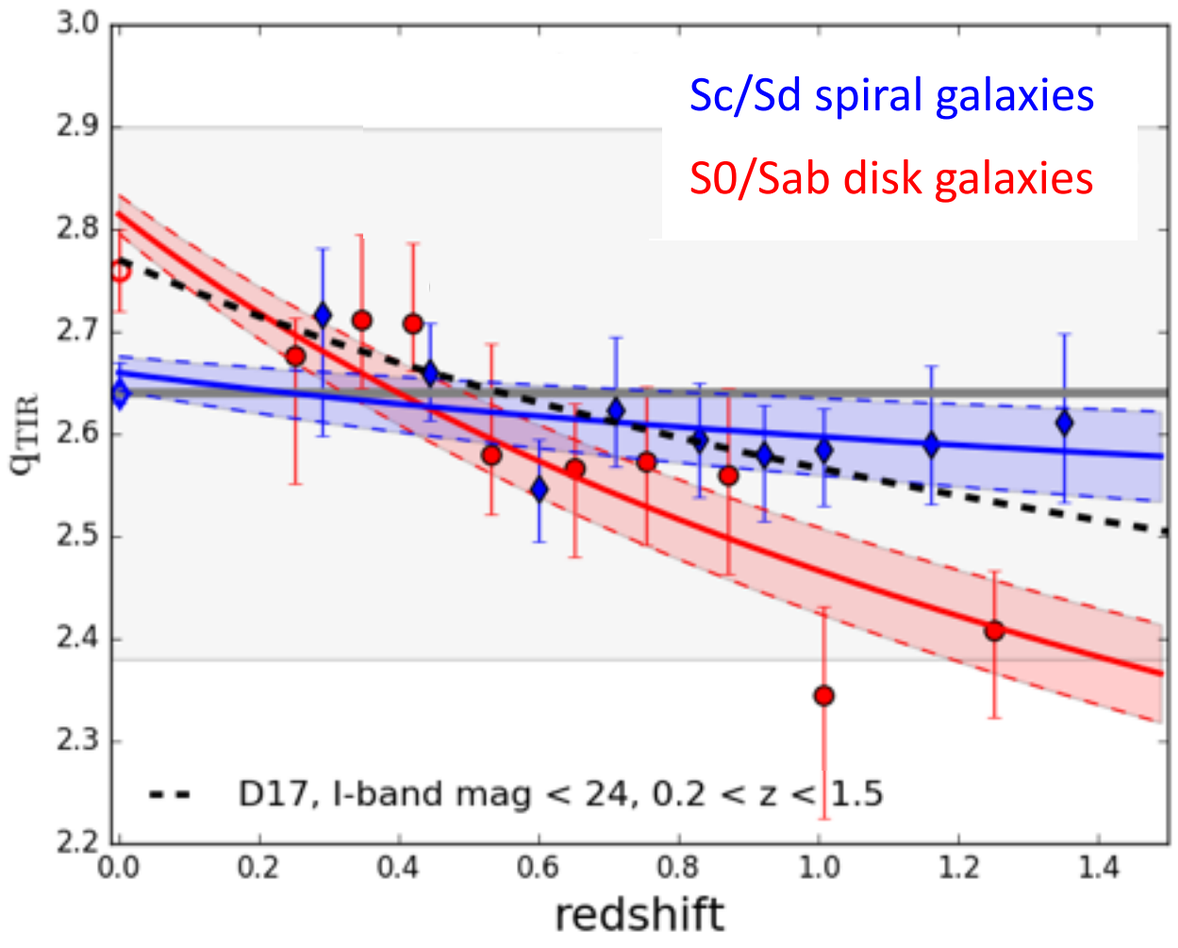


SKA, the synchrotron continuum SFR machine

Daniel Molnár (U. of Sussex ➠INAF Cagliari)
PhD projects

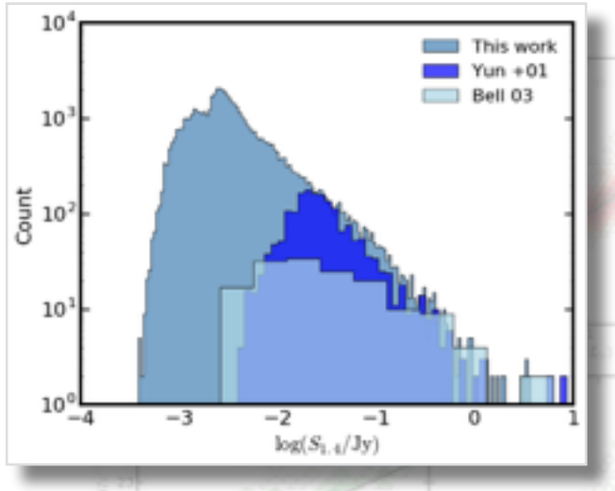
Different redshift-evolution of IR-radio relation depending on galaxy type (Molnár+, 2018):

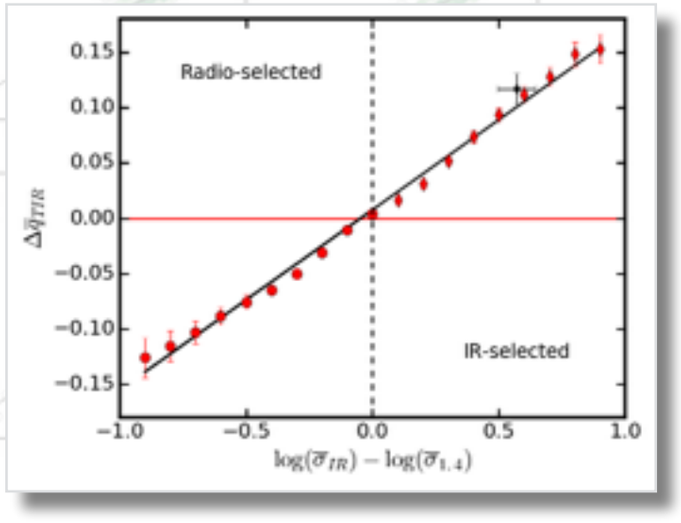
In galaxy disks, radio synch. luminosity traces SFR in the same way for 9.5 Gyr of look-back time.



The z~0 IR-radio relation using >10k SDSS galaxies (Molnár+, in prep.):

A multi-variate investigation of the scatter of the $L_{1.4}$ vs. SFR relation and its selection biases.





Outline

- UK: general policy and funding landscape
- UK SKA status update:
    1. Main UK roles in SKA
    2. UK SKA Science Committee and other ontacts
    3. Anticipated UK community use of SKA
    4. Radio Astronomy Strategic Review 2017 (RASR)
    5. e-Merlin as SDP testbed

General policy and funding landscape in the UK

May 21 science policy speech
@ Jodrell Bank Observatory

29 March 2018

29 March 2018

3 February 2017

Global Headquarters

£16.5 million investment
Tripling of space to 4200 m²
159 seat Council Chamber
10 Video Conference Rooms
On site – March 2017
Completion June 2018

Funders

Department for Business, Energy & Industrial Strategy

Science & Technology Facilities Council

MANCHESTER 1824 The University of Manchester

Cheshire East Council

SKA
SQUARE KILOMETRE ARRAY

Global Headquarters

Venue for the next SKA science meeting

“New Science Enabled by New Techniques in the SKA Era”

(expected: April 8-12, 2019)

Funders

Department for Business, Energy & Industrial Strategy

Science & Technology Facilities Council

MANCHESTER 1824
The University of Manchester

Cheshire East Council

May 21 science policy speech
@ Jodrell Bank Observatory

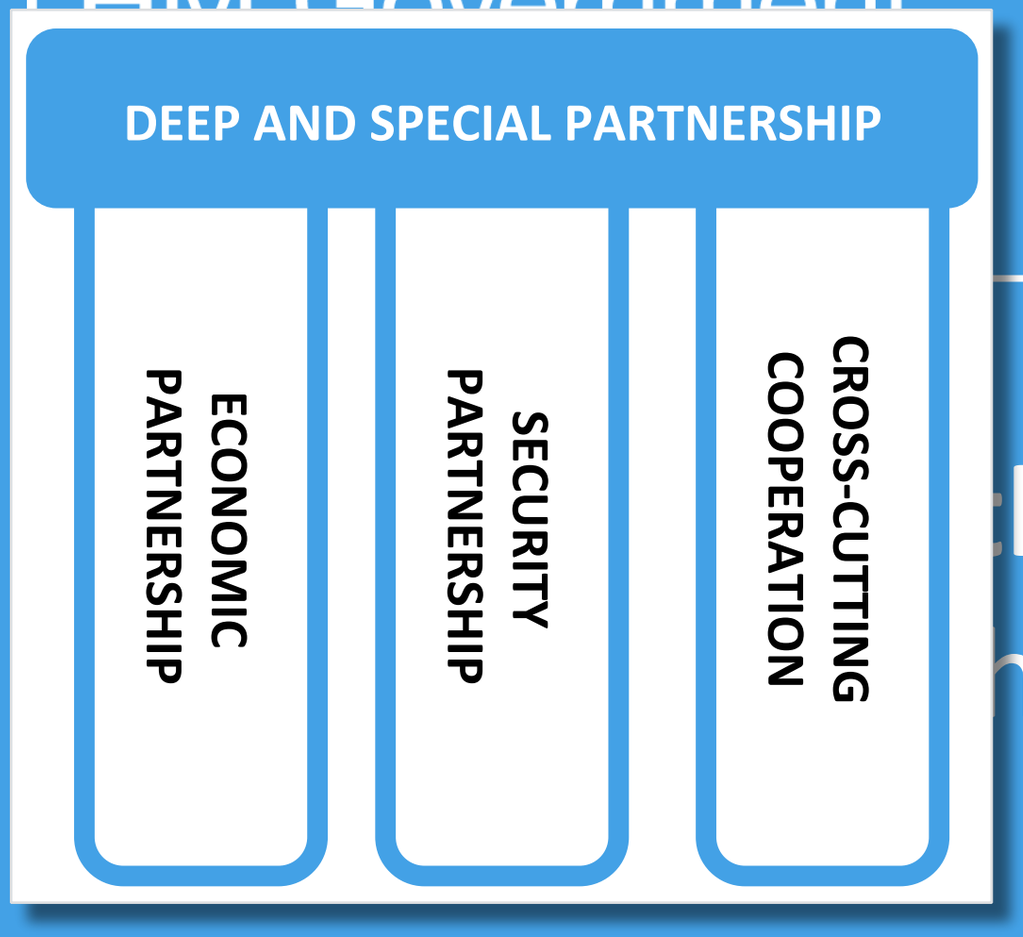
HM Government

Framework for the UK-EU partnership

Science, research and innovation

MAY 2018

HM Government



the UK-EU partnership

and innovation

MAY 2018

HM Government

DEEP AND SPECIAL PARTNERSHIP

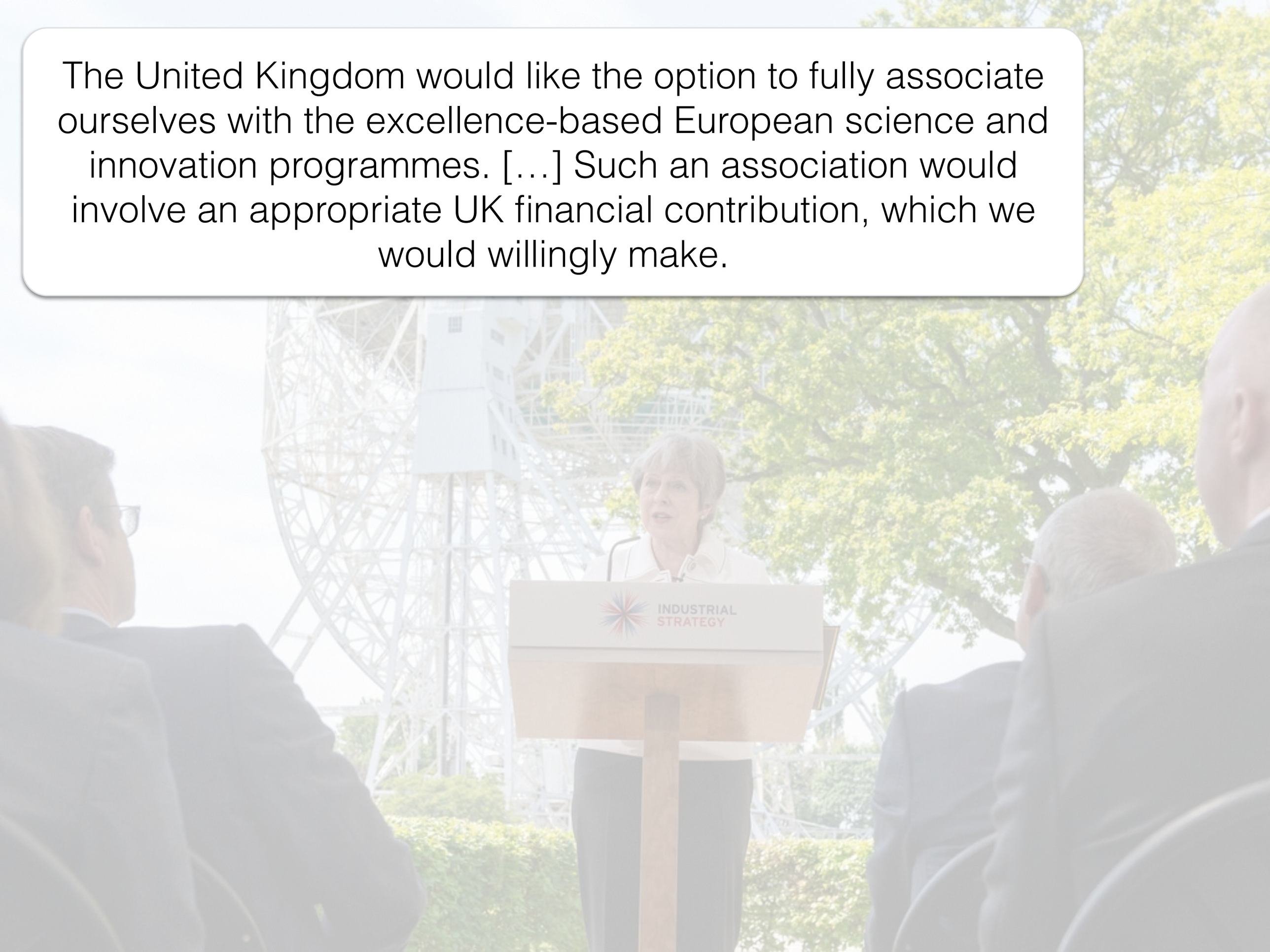
- ECONOMIC PARTNERSHIP
- SECURITY PARTNERSHIP
- CROSS-CUTTING COOPERATION

SCIENCE AND INNOVATION PACT

- DIALOGUE
- PROGRAMMES*
- INFRASTRUCTURE
- EXCHANGE OF INFORMATION
- REGULATION AND ETHICS

MAY 2018

The United Kingdom would like the option to fully associate ourselves with the excellence-based European science and innovation programmes. […] Such an association would involve an appropriate UK financial contribution, which we would willingly make.



The United Kingdom would like the option to fully associate ourselves with the excellence-based European science and innovation programmes. […] Such an association would involve an appropriate UK financial contribution, which we would willingly make.

In return, we would look to maintain a suitable level of influence, in line with that contribution and the benefits we bring. And the UK is ready to discuss these details with the Commission as soon as possible.

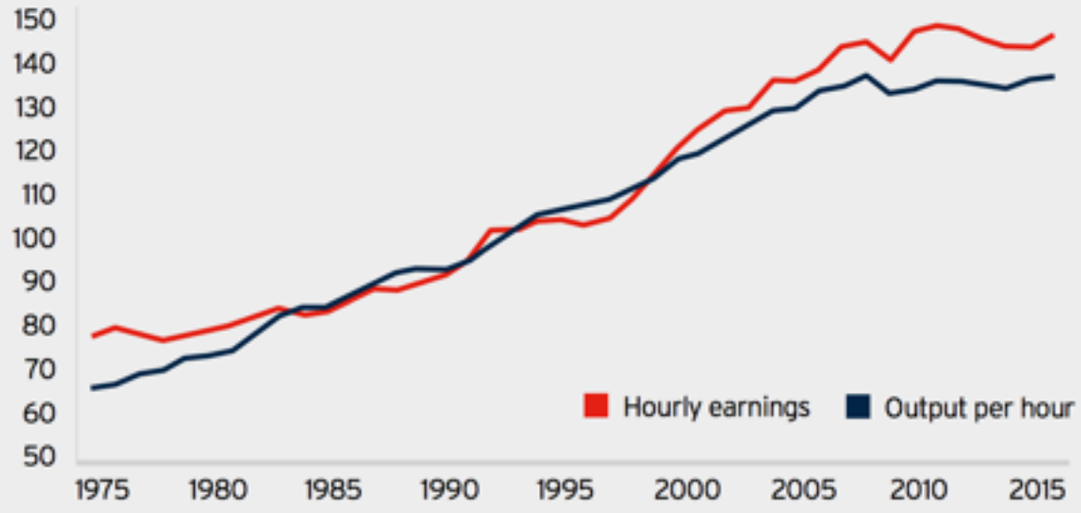
The United Kingdom would like the option to fully associate ourselves with the excellence-based European science and innovation programmes. […] Such an association would involve an appropriate UK financial contribution, which we would willingly make.

In return, we would look to maintain a suitable level of influence, in line with that contribution and the benefits we bring. And the UK is ready to discuss these details with the Commission as soon as possible.

INDUSTRIAL STRATEGY

Rising wages depend on growing productivity

Hourly earnings and output per hour, index: 1993=100



Key policies include:

Ideas

- Raise total research and development (R&D) investment to 2.4 per cent of GDP by 2027
- Increase the rate of R&D tax credit to 12 per cent
- Invest £725m in new Industrial Strategy Challenge Fund programmes to capture the value of innovation

We will set Grand Challenges to put the United Kingdom at the forefront of the industries of the future:

AI & Data Economy
We will put the UK at the forefront of the artificial intelligence and data revolution

Clean Growth
We will maximise the advantages for UK industry from the global shift to clean growth

Future of Mobility
We will become a world leader in the way people, goods and services move

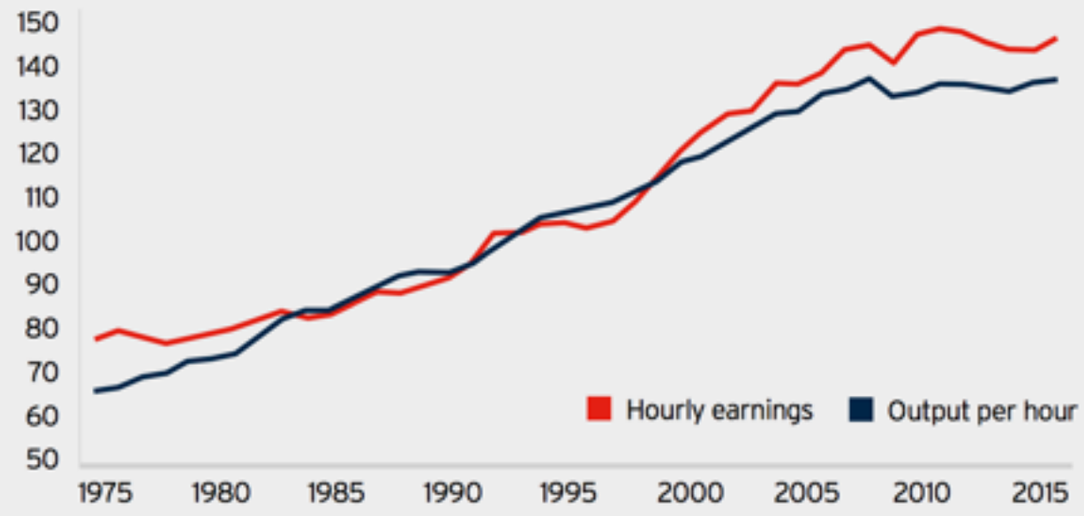
Ageing Society
We will harness the power of innovation to help meet the needs of an ageing society

Source: Industrial Strategy White Paper

INDUSTRIAL STRATEGY

Rising wages depend on growing productivity

Hourly earnings and output per hour, index: 1993=100



Key policies include:

Ideas

- Raise total research and development (R&D) investment to 2.4 per cent of GDP by 2027
- Increase the rate of R&D tax credit to 12 per cent
- Invest £725m in new Industrial Strategy Challenge Fund programmes to capture the value of innovation

We will set Grand Challenges to put the United Kingdom at the forefront of the industries of the future:

AI & Data Economy
We will put the UK at the forefront of the artificial intelligence and data revolution

Clean Growth
We will maximise the advantages for UK industry from the global shift to clean growth

Future of Mobility
We will become a world leader in the way people, goods and services move

Ageing Society
We will harness the power of innovation to help meet the needs of an ageing society

Source: Industrial Strategy White Paper

STFC Centres for Doctoral Training in Data Intensive Science (DISCNet, runs 2017-2023)

- of order 100 studentships with start dates in 2017-2019
- includes industry placements & dedicated training workshops
- 19 participating institutions: Bristol, Cambridge, Cardiff, Durham, Edinburgh, Glasgow, Lancaster, U. of Liverpool, LJMU, Manchester, Open University, Portsmouth, Queen Mary, Sheffield, Southampton, St. Andrews, Sussex, Swansea, UCL

UKRI Centres for Doctoral Training to develop UK skills in Artificial Intelligence (2018-2027)

- of order 1000 studentships with start dates between 2018 and 2023

Science & Technology Facilities Council | UK Research and Innovation

UK SKA status update

UK involvement in official SKA activities

Design consortia:

Work package	Cambridge	Manchester	Oxford	UCL	STFC Labs
Science Data Processor*	x	x	x	x	x
Signal and Data Transport*		x			x
Low-Frequency Aperture Array	x		x		x
Mid-Frequency Aperture Array	x	x			
Telescope Manager					x
Dish			x		x
Central Signal Processor (inc Pulsar search)		x	x		x
Phased Array Feed		x			

*UK consortium lead

Science Working Groups:

SWG Membership	UK Number	Chair/co-Chair
Cosmology	26	
Cradle of Life	8	I. Jimenez-Serra (QMUL)
EoR	7	
Exgal continuum	16	M. Sargent (Sussex)
Exgal spectral line	10	
HI Galaxy	5	
Magnetism	9	
Our Galaxy	9	
Pulsars	10	
Solar helio and iono	21	E. Kontar (Glasgow)
Transients	10	

Source: UK RASR 2017

Key UK SKA contacts

UK SKA representatives:

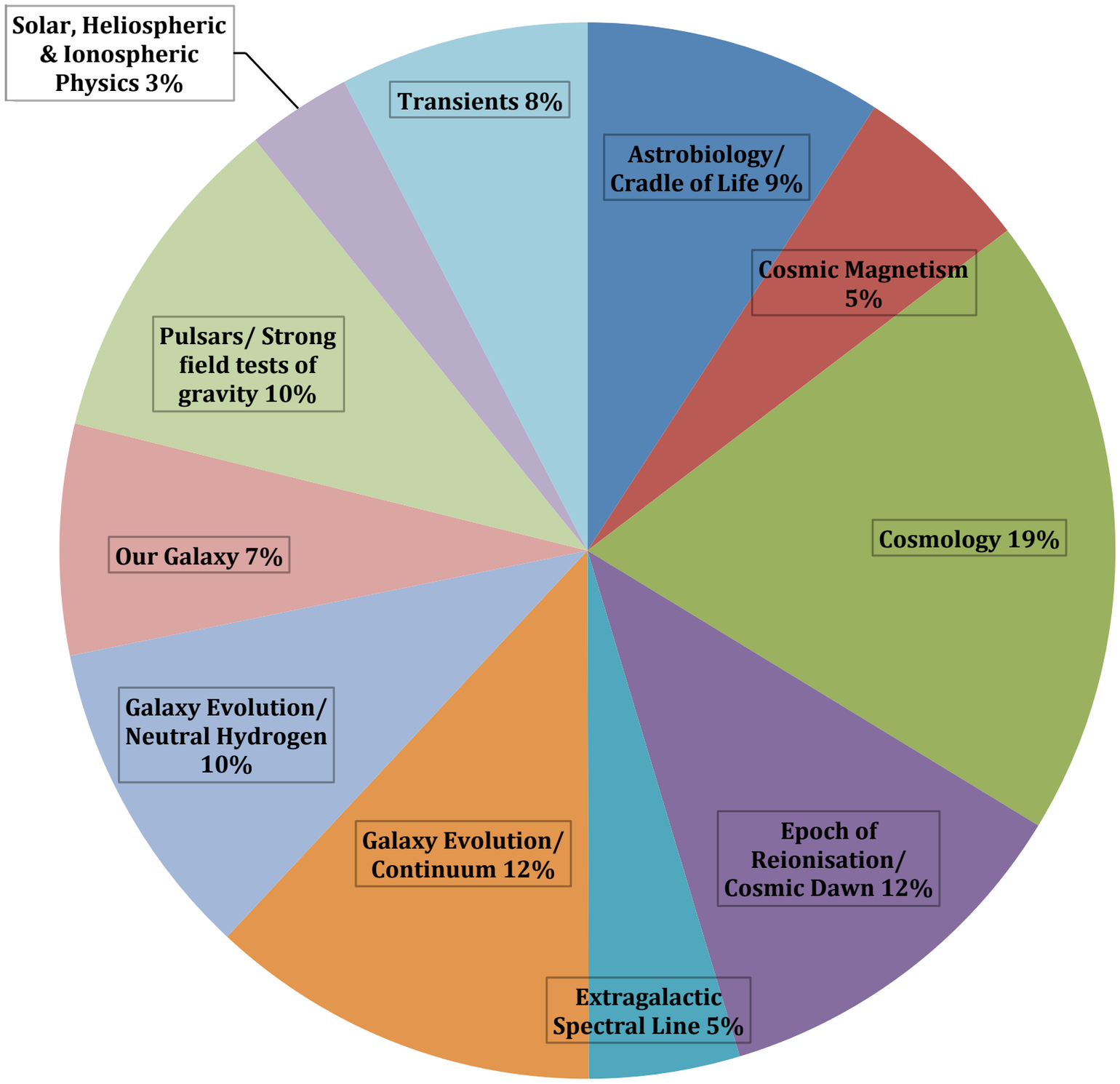
- UK SKA Board members: Mark Thomson (head STFC; voting) & Philip Best (Edinburgh)
- Lead political/intergovernmental work: Adam Baker (UK Gov./BEIS)
- STFC Programme Manager for SKA: Justin O'Byrne

UK SKA Science Committee (UKSKASC):

- Chair: Jonathan Pritchard (Imperial)
- Deputy-chair: Anna Scaife (Manchester)
- Members:

Mark Ashdown (Cambridge)
Philip Best (Edinburgh)
David Britton (Glasgow)
Steve Eales (Cardiff)
Rob Fender (Oxford)
Stephen Serjeant (OU)
David Bacon (Portsmouth)
Mark Birkinshaw (Bristol)
Judith Croston (Southampton)
Stewart Eyres (UC Lancaster)
Steven Longmore (LJMU)
Catherine Walsh (Leeds)

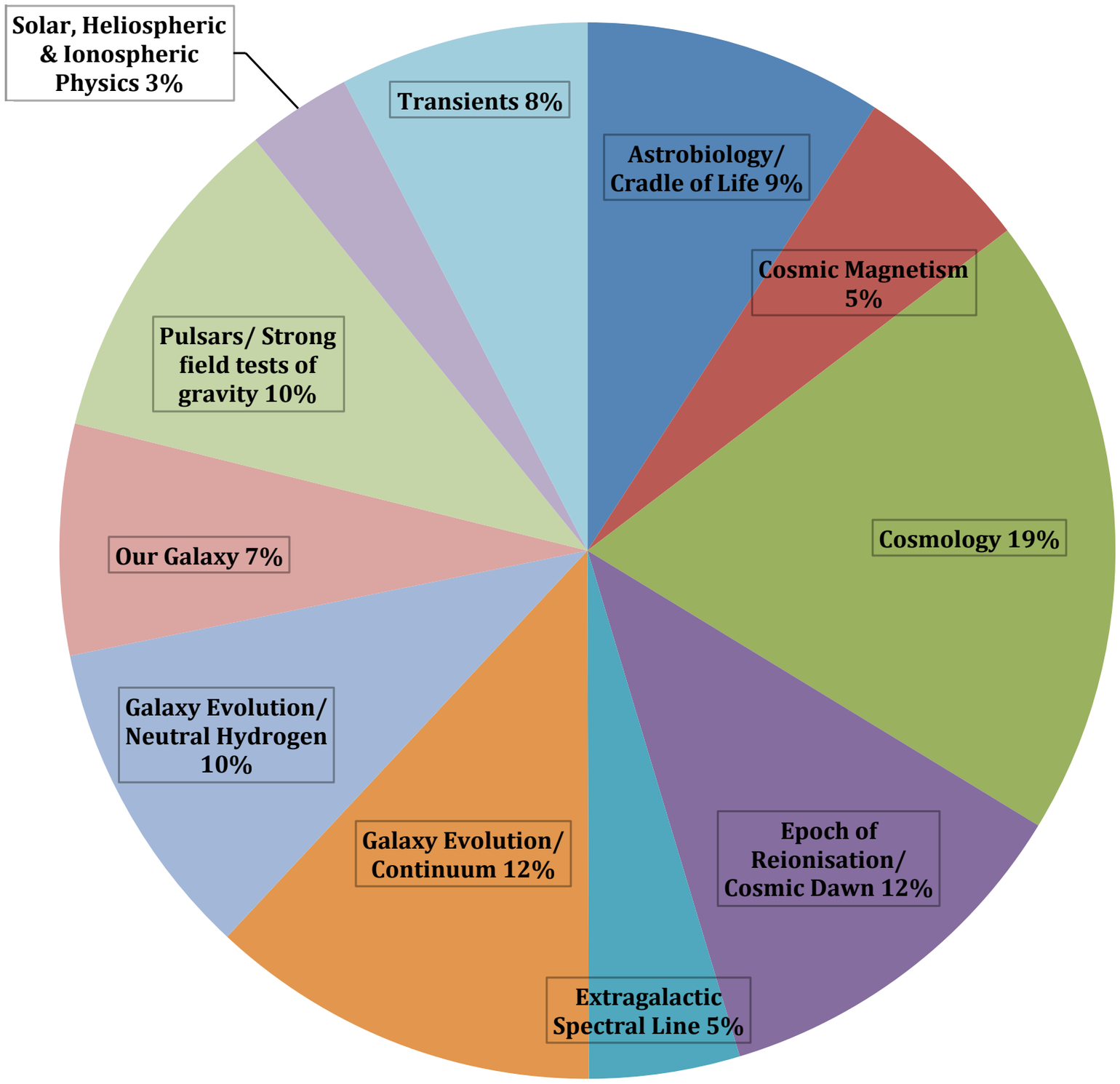
Anticipated UK Community Use of SKA



Interest well beyond the “traditional” cm-based radio astronomy community and spread across >30 institutions.

Source: UKSKASC questionnaire 2016

Anticipated UK Community Use of SKA



Interest well beyond the "traditional" cm-based radio astronomy community and spread across >30 institutions.

However …

Source: UKSKASC questionnaire 2016

UK Radio Astronomy Strategic Review 2017 (RASR)

- STFC Balance or Programmes Review 2016:

“In the case of radio astronomy, it can be argued that the total cost to STFC is now high relative to the overall volume of activity and UK interest in the area”.

UK Radio Astronomy Strategic Review 2017 (RASR)

- STFC Balance or Programmes Review 2016:

"In the case of radio astronomy, it can be argued that the total cost to STFC is now high relative to the overall volume of activity and UK interest in the area".

- Remit of subsequently commissioned UK RASR 2017:

"… in consultation with the radio community, assess and tension the range of facilities available to UK astronomers and determine the key SKA 'pathfinders' (surveys and telescopes) in preparation for the main UK-led SKA science".*

*excl. ALMA & JCMT

- Download link: https://stfc.ukri.org/files/rasr/

(see also ASTRONET European Radio Astronomy review 2015)

UK RASR 2017 - SKA pathfinder/precursor* involvement

Government-funded observatories:

- LOFAR (230k GBP/yr operations contribution): 1 UK LOFAR station; UK LOFAR institutes to bid for financial support from STFC for LOFAR 2.0 upgrade
- e-Merlin (~2.5M GBP/yr operations contribution): 7(8)-dish array in northern/central England jointly funded by U. of Manchester & STFC (+ CUGA for Goonhilly incorporation)
- EVN/JIVE (~200k GBP/yr): involvement in European VLBI network includes VLBI sessions incl. e-Merlin; parallel significant funding from Newton fund for VLBI development projects in Africa (DARA programme) and Asia

\+ Mullard Radio Astronomy Observatory (Cambridge-funded)

Further precursors/pathfinders (mostly in-kind UK contributions):

- MeerKAT
- ASKAP
- MWA (Murchison Wide-field Array)
- HERA (Hydrogen Epoch of Reionization Array)
- VLA, GMRT, ATCA, etc.

*Precursor - observatory located at future SKA site; pathfinder - other observatory with relevant technology or carrying out SKA-like science

UK RASR 2017 - Recommendations (abridged)

- Ensure sufficient funding for early-career researchers to avoid brain-drain toward SKA member states with generously funded fellowship schemes.
- Involvement in SKA precursors such as MeerKAT, ASKAP and MWA should be encouraged and supported as a strategic route to involvement with SKA science.
- Acquire government support for SKA as a strategic area for developing Big Data and HPC skills+infrastructure.
- Ensure that funding will be available to support an SKA Regional Centre and for the provision of a domestic user support structure.

UK RASR 2017 - Recommendations (abridged)

- Ensure sufficient funding for early-career researchers to avoid brain-drain toward SKA member states with generously funded fellowship schemes.
- Involvement in SKA precursors such as MeerKAT, ASKAP and MWA should be encouraged and supported as a strategic route to involvement with SKA science.
- Acquire government support for SKA as a strategic area for developing Big Data and HPC skills+infrastructure.
- Ensure that funding will be available to support an SKA Regional Centre and for the provision of a domestic user support structure.

- Maintain funding (at least at current levels) for LOFAR, e-Merlin & EVN/JIVE operations (in this priority order).
- Set aside funding for e-Merlin upgrades that are crucial for capacity-building.

e-Merlin as a Science Data Processor (SDP) testbed

e-Merlin software upgrade (starting mid 2019):

- Deploy prototype versions of SDP (components) in a real-world environment.
- More standardized e-Merlin data processing with faster throughput.
- SKA-like experience (for both science users and software developers).
- Links to EU AENEAS project and UK HPC infrastructure (GridPP & DiRAC).

e-Merlin is open to observing proposals from both intra- and extra-UK PIs!
Next deadline (cycle 8): autumn 2018.

- “UK remains strongly committed to the project and is very keen on European engagement both technically and scientifically”. (Both to strengthen the HQ and with a European Regional Data Centre in mind.)
- The UK is buying into SKA1 at the 15-20% level, and thus aims to achieve strong UK-led scientific return.
- IGO convention open for initialling, with a signing ceremony planned for later this year. The UK has not initialled yet but is expected to do so soon.

- SKA HQ at Jodrell Bank nearing completion; together with the existing JBO activities, Jodrell Bank is set to stay a nexus for astronomy throughout the SKA era.

- "UK remains strongly committed to the project and is very keen on European engagement both technically and scientifically". (Both to strengthen the HQ and with a European Regional Data Centre in mind.)
- The UK is buying into SKA1 at the 15-20% level, and thus aims to achieve strong UK-led scientific return.
- IGO convention open for initialling, with a signing ceremony planned for later this year. The UK has not initialled yet but is expected to do so soon.

UK SKA community Town Hall meeting:

July 2 @ Royal Astronomical Soc. in down-town London

CH community welcome to attend!

- SKA HQ at Jodrell Bank nearing completion; together with the existing JBO activities, Jodrell Bank is set to stay a nexus for astronomy throughout the SKA era.