School of Physics & Astronomy
FACULTY OF MATHEMATICS & PHYSICAL SCIENCES

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Goonhilly Telescopes and e-Merlin

Melvin Hoare

Background

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- Ex-BT site now owned by the SME Goonhilly Earth Station Ltd (GES) who run a satellite communications business
- Agreement with the Consortium of Universities for Goonhilly Astronomy (CUGA) to use two of the 30 m class dishes for radio astronomy

Radio Dishes

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- Goonhilly 1
- 26 m
- Use at L-band with spare e-Merlin receiver at prime focus

Radio Dishes

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- Goonhilly 3
- 29 m
- Use at C-band with a new receiver built at Oxford

Goonhilly + e-Merlin

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Goonhilly + e-Merlin

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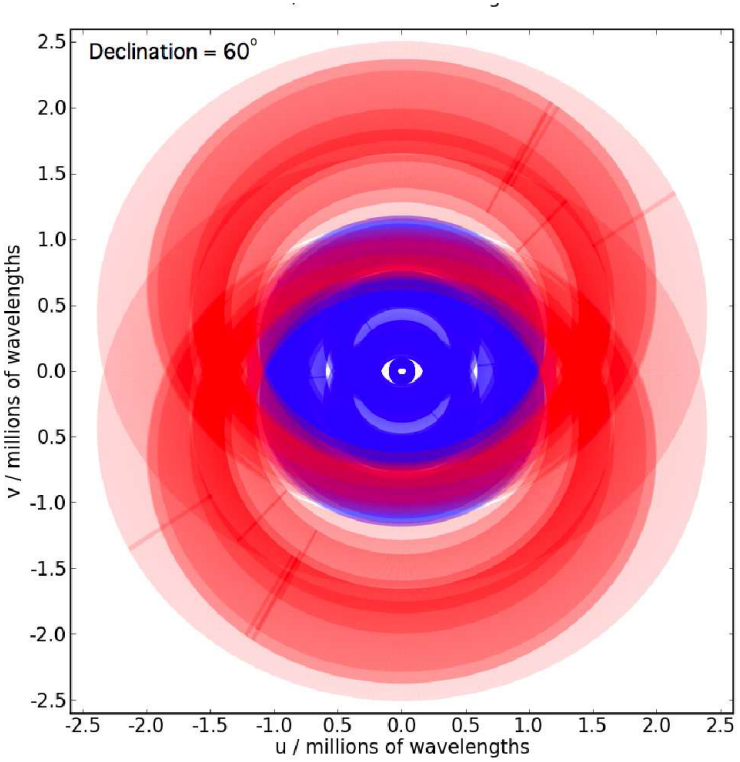
- Adding Goonhilly doubles the baseline of e-MERLIN from 200 to 400 km



Heywood et al. 2011 arXiv1103.1214

Goonhilly + e-Merlin

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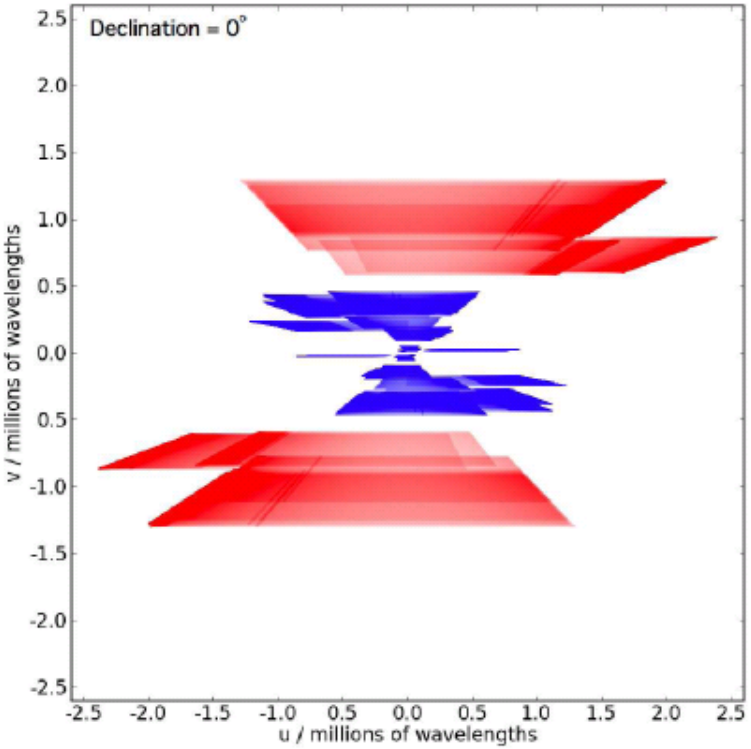
- Greatly improves beam shape for equatorial and southern targets for joint studies with ALMA and other ESO telescopes
- Matched resolution studies of the ionized gas (e-Merlin) and molecular gas and dust (ALMA), e.g. in star formation, starburst galaxies, AGN and high-z galaxies



Heywood et al. 2011 arXiv1103.1214

Goonhilly + e-Merlin

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Declination (and array)	B_{maj} (arcsec)	B_{min} (arcsec)	PA (deg)	B_{maj} / B_{min}
δ = -20° (eM)	0.688	0.159	12.72	4.33
δ = -20° (eM+G)	0.352	0.118	163.482	2.98
δ = 0° (eM)	0.393	0.166	22.28	2.37
δ = 0° (eM+G)	0.195	0.116	-29.65	1.68
δ = +30° (eM)	0.225	0.186	23.45	1.21
δ = +30° (eM+G)	0.135	0.120	134.39	1.13
δ = +60° (eM)	0.200	0.183	0.74	1.09
δ = +60° (eM+G)	0.133	0.126	-1.06	1.06

Heywood et al. 2011 arXiv1103.1214

Datalink to Jodrell Bank

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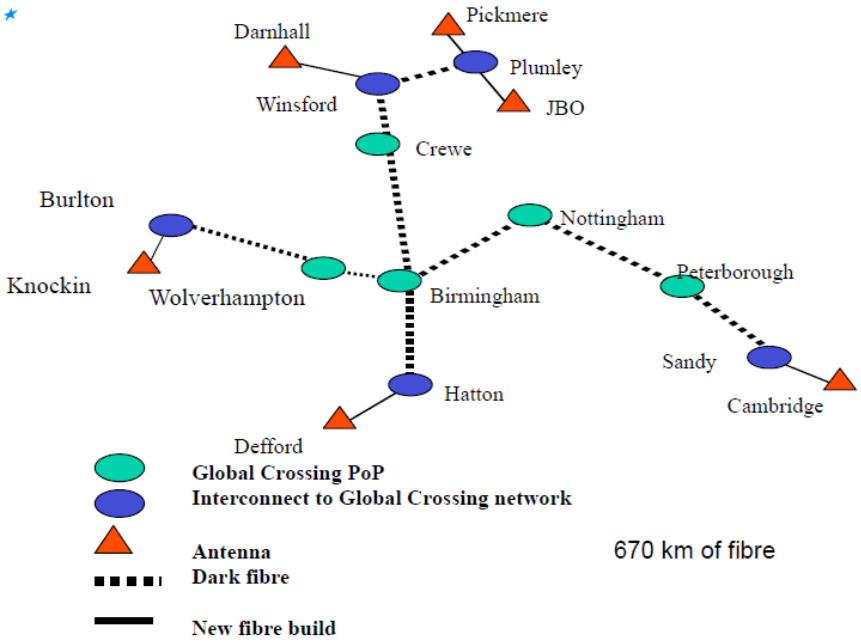
- JANET Reach project underway for datalink to the correlator at Jodrell Bank with Adaptive Array Systems Ltd.
- Initially for 2 Gbps, capable to 10 Gbps and plans for future upgrades

janet



Goonhilly + EVN

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- Goonhilly's baselines also fill a gap in uv coverage between e-MERLIN and the EVN network

Goonhilly + EVN

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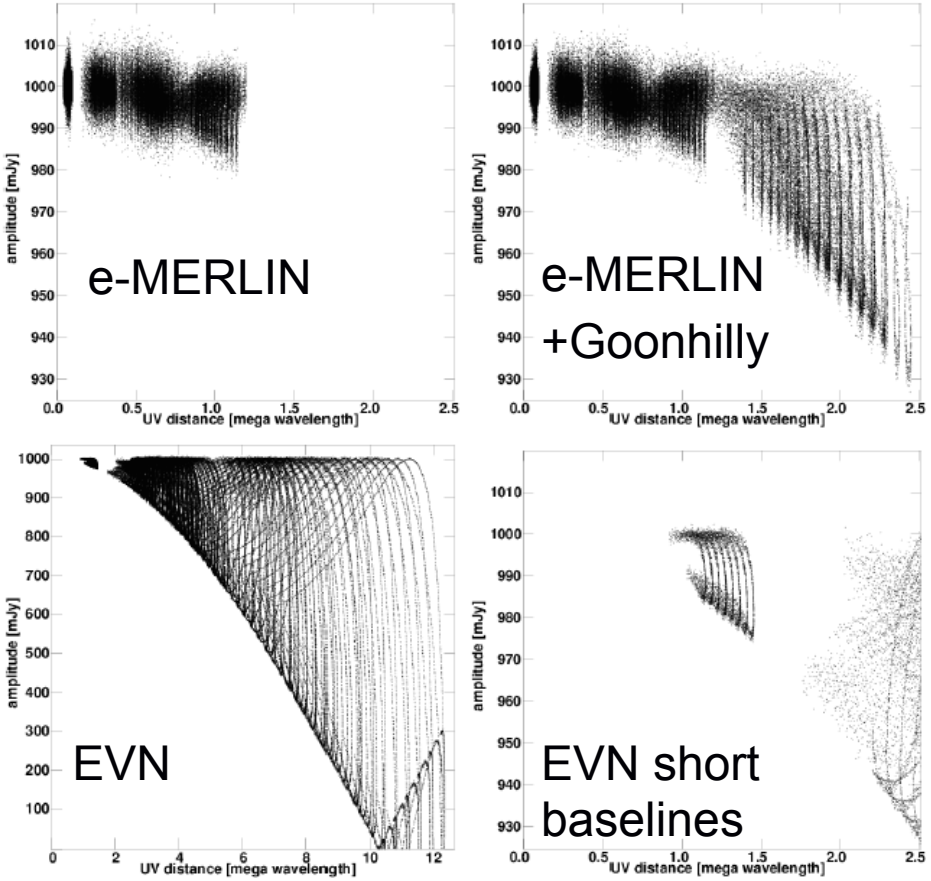
- Goonhilly's baselines fill a gap in the uv coverage between e-MERLIN and the EVN network



Kloeckner et al. 2011 arXiv1103.3600

Single-dish astronomy

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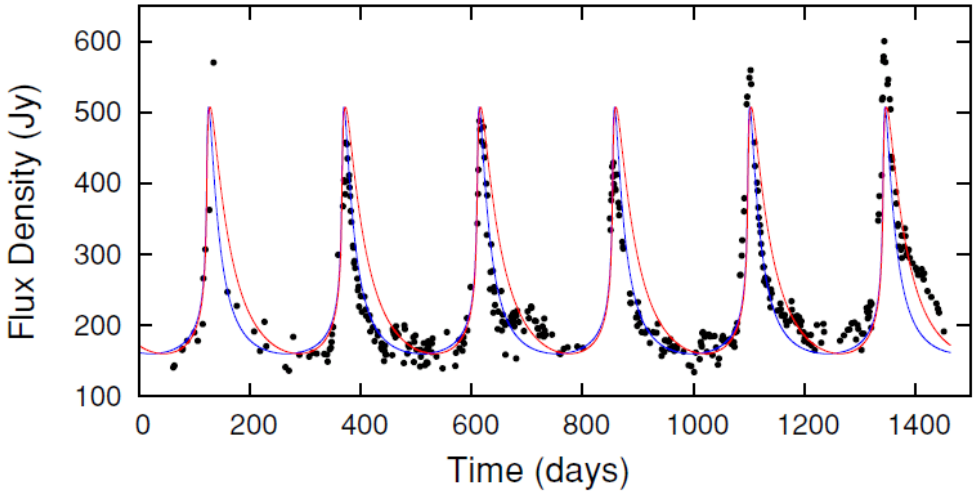
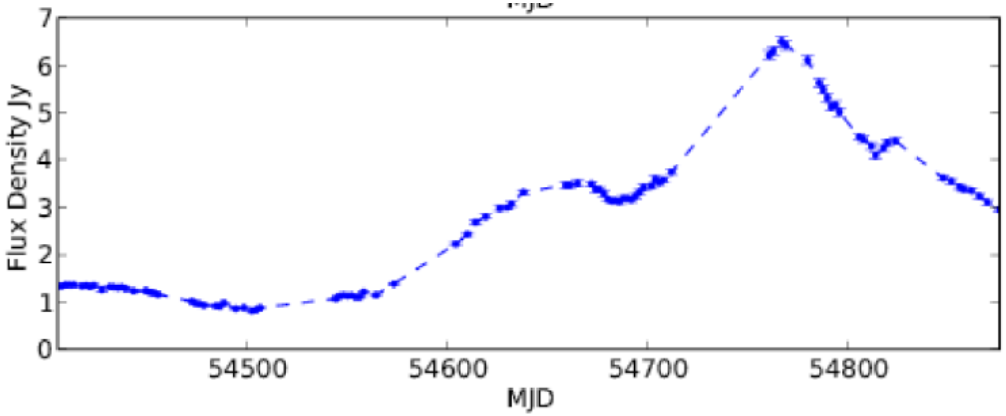
- Single-dish monitoring programmes
  - Masers
  - AGN
  - Scintillation
  - Binaries
  - Transients
- Excellent hands-on student training facility





Goonhilly and the AVN

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- Synergy with antenna conversion projects for the African VLBI Network (AVN) in Ghana, Kenya, Zambia and Madagascar

Newton Fund Projects

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- £950k training project in AVN partner countries with SA
- £600k radio astronomy instrumentation project with Mexico
- Plans to expand to include big data training and extend to include Latin America and SE Asia

Newton Fund

DARA
DEVELOPMENT IN AFRICA WITH RADIO ASTRONOMY

Goonhilly Outreach

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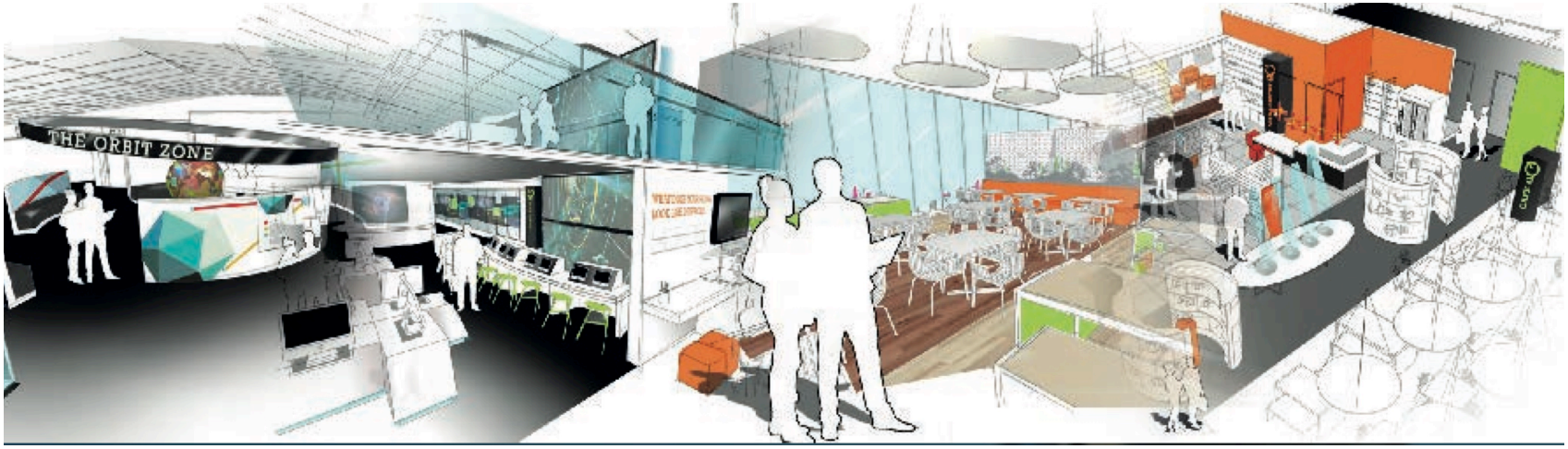
- Large potential showcase for university astronomy research and impact
- Detailed designs for 100 000 visitor per year visitor centre



Current Status

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- Engineering visit by JBO staff revealed no obvious show stoppers to conversion to astronomical control or to the mounting of the receivers
- Need additional contributions to complete the conversion

The CUGA Consortium

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- Contribution also received from University of Southampton

Summary

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- Addition of Goonhilly dishes to e-Merlin can significantly enhance its resolution and synergy with ALMA
- Conversion project has synergy with the AVN that will provide the 1000 km baselines for VLBI with SKA1 Mid
- Collaboration with GES Ltd provides means to explore future commercial opportunities in the space sector
- CUGA is basis for current Newton and future GCRF radio astronomy activities