A VLBI antenna for the island of Madeira

Pedro Augusto

Grupo de Astronomia da Universidade da Madeira

Centro de Astronomia e Astrofisica da Universidade de Lisboa

et... YOU
A VLBI antenna for Madeira

PRESENT

10th EVN Symposium
87 external participants

This talk

VLBI antenna (1998-2010-…)

10 antennas

18 antennas
SOCIAL/EDUCATIONAL

Currently: one resident professional astronomer at Madeira

Plan: - increase this number ✓
- increase cooperation with worldwide astronomical institutions (namely EC) ~

Outcomes: - professional astronomy is possible, residing at Madeira ✓ (even AIPS)
- development of equipment and library material ✓
- two MSc students start work by 2000 ✓
- three-four young researchers conduct observational projects ✓ (six)
- public/scientific presentations by the MARGA team ✓

300 000 locals: - contact with the progress of astronomy research at Madeira/worldwide ✓
- “Astronomy Party” events (once a year) ✓ (9th)

Long-term plans: - open Astronomy degree at the Universidade da Madeira ✓
  ✓ - build a major astronomical facility at Madeira (radio or optical)
  XX - build a Planetarium/Museum for the Public Awareness of Science
Still history (sorry a million…)

- at the EVN/JIVE Symposium No.4, 23/10/1998

Short talk allowed on Madeira antenna plans
A VLBI antenna for Madeira

Declination $+20^\circ$  
10 EVN stations + Madeira
<table>
<thead>
<tr>
<th>MAXIMUM BASLINE (RESOLUTION)</th>
<th>EVN + Madeira</th>
<th>EVN</th>
<th>VLBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stations</td>
<td>Jb, Wh, Mt, Sh, Yi, Tr, Sm</td>
<td>Sh, Sh, Mt, Sm, Tr, Sm, Mt, Sh, Yi, Tr, Sm</td>
<td>Sh, Sh, Yi, Yi, Yi, Mt, Mt, Mt, Mt, Mt</td>
</tr>
<tr>
<td>9950 Km (19 mas)</td>
<td>9950 Km</td>
<td>9950 Km</td>
<td>4600 Km</td>
</tr>
<tr>
<td>9950 Km (3.7 mas)</td>
<td>9950 Km</td>
<td>9950 Km</td>
<td>4600 Km</td>
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<tr>
<td>9950 Km (1.3 mas)</td>
<td>9950 Km</td>
<td>9950 Km</td>
<td>4600 Km</td>
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<tr>
<td>9950 Km (0.6 mas)</td>
<td>9950 Km</td>
<td>9950 Km</td>
<td>4600 Km</td>
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</table>

<table>
<thead>
<tr>
<th>MAXIMUM FREQUENCY</th>
<th>9.2 cm</th>
<th>18 cm</th>
<th>6 cm</th>
<th>1.3 cm</th>
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<tbody>
<tr>
<td>EVN</td>
<td>8476 Km</td>
<td>8476 Km</td>
<td>8476 Km</td>
<td>8476 Km</td>
</tr>
<tr>
<td>VLBA</td>
<td>8600 Km</td>
<td>8600 Km</td>
<td>8600 Km</td>
<td>8000 Km</td>
</tr>
<tr>
<td></td>
<td>(22 mas)</td>
<td>(4.4 mas)</td>
<td>(4.5 mas)</td>
<td>(0.3 mas)</td>
</tr>
</tbody>
</table>
Pedro Augusto

A VLBI antenna for Madeira

Antenna: 25m up to 43 GHz

Seismically stable; hurricane free

Recommendation signed by “70 scientists from 16 countries”

A New Radio Telescope in Madeira/Porto Santo

We, signed below, strongly recommend a new radio telescope to be built at the Archipelago of Madeira (Portugal, 16° W, 33° N). If part of the European VLBI Network (EVN), this telescope would both allow extra resolution for the EVN and more efficient coverage of the “mid-Atlantic gap” present on Global VLBI observations.

<table>
<thead>
<tr>
<th>INSTITUIÇÕES NACIONAIS</th>
<th>NOME</th>
<th>ASSINATURA</th>
<th>DATA</th>
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<tbody>
<tr>
<td>UNIVERSIDADE DA MADEIRA</td>
<td>PEDRO MANUEL EDOLOU</td>
<td>Pedro Augusto</td>
<td>30/7/98</td>
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<tr>
<td>IST/UTF</td>
<td>R. S. AUGUSTO</td>
<td>Antonio A. da Costa</td>
<td>30/7/98</td>
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<tr>
<td>CAUP</td>
<td>PEDRO PINA AVELINO</td>
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<td>OBSERVATÓRIO ASTROFÍSICO</td>
<td>CATERINA G. CRUZ</td>
<td>Carolina Coelho</td>
<td>5/11/98</td>
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<tr>
<td>LISBOA</td>
<td>CRISTINA S. S.</td>
<td>Margarida Serote</td>
<td>6/11/98</td>
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A New Radio Telescope in Madeira/Porto Santo

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<tr>
<td>Joint Institute for VLBI in Europe</td>
<td>Dr. H.J. van Langevelde</td>
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<td>Joint Institute for VLBI in Europe</td>
<td>Lo. Simpson</td>
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<td>Max Planck-Institut für Radioastronomie</td>
<td>Ric Schwartz</td>
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<td>Franco Martovani</td>
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<td>Univ. of Ioannina</td>
<td>Nectaria Gizani</td>
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<td>BOLOGNA UNIVERSITY</td>
<td>Anna Maria Giacani</td>
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<td>Inst. Radioastronomia</td>
<td>Annibale Ciacci</td>
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<td>Observatorio Astronómico Nacional</td>
<td>Francisco Colomer</td>
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<td>Astrop Space Centre</td>
<td>Andrew Chupeiko</td>
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<tr>
<td>Beijing Astronomical Observatory</td>
<td>Wenwu Tian</td>
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<tr>
<td>NRAO, Charlottesville, VA, USA</td>
<td>Ed Fomalont</td>
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<tr>
<td>Institute of Space &amp; Astronautical Science</td>
<td>Jim Lovell</td>
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Today:

- Reduce the infamous ‘mid-atlantic gap’ now also seen in the u-v plane coverage of EVN (due to Arecibo)
- The argument only gets stronger when considering Hartebeesthoek (Hh)
- As a whole on the planet, the EVN has an east-west configuration
- Approaching the southern hemisphere gets better sensitivity and…
- all the action will take place there in the next decades (ALMA, SKA, E-ELT).
- Ideal site: shallow valley protected from man made interference; not exposed to frequent gusty/very strong winds

- Seven sites (A-G) were initially selected for on-site inspection

- Two (D and F/G) are now left

- D at 1300m

- F/G at 1000-1100 m (gentle westlooking slope)
A VLBI antenna for Madeira
A VLBI antenna for Madeira
Results:

- Wind is not a problem for any of the two sites.

- Column water vapour information is still being assessed from satellite data [looks promising].

- RFI: both sites are excellent. At peak interference, both are better than the IAU recommendations by a factor of over 20! And by a much higher factor at the mean RFI level.
A VLBI antenna for Madeira

More islands

The current move south of the largest astronomical instruments all skyrocket and make islands as particularly relevant places for VLBI radio antennas.
Comments to

“The ASTRONET Infrastructure Roadmap”
2nd July 2008

“1 – Where have current long-range radio interferometric observatories gone from your document? (e.g. European VLBI Network – EVN and MERLIN; e-version of both, preferably).”

“miniscule amount it really devotes to this topic.”

“EVN and MERLIN became low-priority instruments - the only long-range interferometers in the discussion.”

“number of pages: [five for] optical telescopes and… two-pages to mm/sub-mm/Radio Observatories. […] four lines of text are devoted to Radio Observatories in Europe.”

Unfortunate citation: “… as claimed by the European VLBI network.”
“e-EVN […] should beat in sensitivity the pair “EVLA/e-Merlin” (<1mJy expected) […] Are we proud of all European achievements and ambitions… or just on part of them?”

“wavelength concerns to panel B. […] jumping over centimetre wavelengths.”

“1.3 – Why are they relevant?” [e-MERLIN and e-EVN] [resolution; pan-european; answer to Science Vision questions; Public Awareness of Science]

“1.4 – A trick-surprise on my sleeve…[Madeira]”

“The current plan is to place a 40m, 86 GHz capable instrument in Madeira. […] join] mm-e-EVN”

“a > €10M project […] “small” and “short-term” [cost] categories. […] (ground-based, near-term).”
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Might be on 2020 review by Richard Porcas (2010-20)...

... or on 2040-50 review
EXTRA, EXTRA!...

HOT news:

FCT has joined ASTRONET
CONSORTIUM

National

International, i.e.,

YOU

1st the People

2nd the Institution

augusto @ uma.pt
ACKNOWLEDGEMENTS
our very serious Site Surveying Committee
NOT the end...