



## RadioNet support for Short Term Missions (staff exchange) Application form

STM INFORMATION	
APPLICANT 'S NAME	Mariet Venter
APPLICANT'S AFFILIATION	SKA South Africa
HOST INSTITUTE	Cagliari Astronomical Observatory (OAC) National Astrophysical Institute (INAF) Via della Scienza n° 5 09047, Selargius, CA, Italia  Giampaolo Serra Office Phone: +39 070 71180 223 E-mail: gserra@oa-cagliari.inaf.it
DATE OF THE STM	Up to two weeks before December 2017
TOTAL COST OF STM	~EURO 2000
OTHER SOURCES OF FUNDING	SKA South Africa
<b>Request</b> <i>(max. 2,5 pages)</i>	
Topic	<p>Participation in the next Sardinia Radio Telescope (SRT) holography campaign.</p> <p>Microwave holography, as applied to reflector antennas, is a technique that utilises the Fourier transform relationship between the complex far-field radiation pattern of an antenna and the complex aperture distribution. The technique is based on connecting two antennas interferometrically and correlating the amplitude and phase response received from strong signals such as geostationary satellites. Consequently, resulting data can be used to characterise surface roughness, panel alignment and sub-reflector position.</p> <p>This is crucial for the performance enhancement of a radio telescope. Collaboration and training on this topic will directly feed into scientific results for the SRT and the on-going African VLBI Network (AVN) project.</p>
Proposed work	<p>After the refurbishment of the SRT active surface, the photogrammetric measurement of its 64-m diameter reflector, scheduled for August 2017, will align the 1008 active panels with approximately 0.5 mm accuracy. This surface accuracy will allow the telescope to observe up to 38 GHz with an efficiency of about 50%. However, it is mandatory to improve such an accuracy to ensure the same efficiency when the higher frequency (under construction) receivers will operate on the SRT.</p> <p>Therefore, holographic measurements will be carried out in fall 2017 with the aim to align the surface panels better than 0.2 mm accuracy, an outcome which is hardly reachable on a large reflector such as the SRT by means of photogrammetric measurement.</p> <p>Holography maps of the SRT main reflector will be performed at an antenna elevation of 44° by using an 11.5 GHz signal transmitted by a geostationary satellite and possibly even at 30°, if a suitable Atlantic or Indian satellite is available around the same frequency.</p> <p>As part of this work, it is possible to contribute to the preparation of the observation schedule in order to map the antenna radiation pattern around the satellite and consequently give support to the holographic data analysis.</p>

<p>Cross-disciplinary</p>	<p>The AVN project is a Square Kilometre Array (SKA) South-Africa (SA) initiative, funded by the African Renaissance Fund (ARF) and lead by the SKA South Africa AVN team. With this project, new antennas are to be constructed in various African countries or several large antennas are envisioned to be converted into radio astronomy telescopes.</p> <p>The AVN team is currently busy with its first conversion in Ghana where there is minimal knowledge of the alignment of the antenna structure or surface roughness. Also, within the AVN team there is limited experience in the microwave holography process but has been fortunate to engage with INAF in this regard. We wish to continue the collaboration for the benefit of the African radio astronomy communities. AVN is equally a training project as it is a scientific/engineering project where focus will be placed on involvement from local scientists in the respective holographic campaigns.</p>
<p>Impact</p>	<p>The impact will be twofold. Firstly, towards development of radio astronomy communities and expertise on the African continent and secondly, in the form of improved scientific results as AVN intends to perform VLBI science with EVN which would fill a large gap in the <i>uv</i>-plane.</p>
<p>Curriculum Vitae</p>	<p><b><u>Employment</u></b></p> <p><b>SKA South Africa</b>, Cape Town, SA — Jnr Electromagnetics Researcher (Jan 2016 – present)</p> <p>Project: African VLBI Network  Responsibilities:</p> <ul style="list-style-type: none"> <li>- Electromagnetic analysis</li> <li>- Support systems engineer</li> <li>- Systems engineering co-lead on small scale training telescope</li> <li>- Systems engineering lead on holography (Ghana on-site)</li> </ul> <p>Other activities:</p> <ul style="list-style-type: none"> <li>- Presentations/training as part of African outreaches</li> <li>- International collaborations</li> </ul> <p><b>Magus Pty</b>, Stellenbosch, SA — Internship (Nov 2015 - Dec 2015)</p> <ul style="list-style-type: none"> <li>- Research and design of antennas for the Antenna Magus software package.</li> </ul> <p><b>Reutech Radar Systems</b>, Stellenbosch, SA — Vacation Work (Jun 2012 - Jul 2012)</p> <ul style="list-style-type: none"> <li>- Assistant to senior radio frequency engineer.</li> </ul> <p><b><u>Education</u></b></p> <p>Stellenbosch University, Stellenbosch, SA — M.Eng. (Electronic) (Jan 2014 - Dec 2015)  “Investigation and Characterization of the HERA Dish and Feed using Electromagnetic Simulations”</p> <ul style="list-style-type: none"> <li>- Presented work at NRAO in Green Bank, West Virginia in June 2016.</li> <li>- Postgraduate subjects: Antennas, Advanced Electromagnetics, Method of Moments, Microwave Networks &amp; Electronics</li> </ul> <p>Stellenbosch University, Stellenbosch, SA — B.Eng (Electrical and Electronic - Telecommunications) (Jan 2010 - Dec 2013)</p> <p>[Degrees accredited internationally by the Washington Accord under the Engineering Council of South Africa (ECSA) (<a href="http://www.ieagreements.org/Washington-Accord/signatories.cfm">http://www.ieagreements.org/Washington-Accord/signatories.cfm</a>)]</p> <p><b><u>Skills</u></b></p> <p>FEKO (Advanced), CST Microwave Studio (Good), AWR Design Environment (Good), GRASP (Advanced), Antenna Magus (Good), Matlab (Good), LaTeX (Good), Microsoft Word (Advanced), Microsoft Visual Studio (Basic), Microsoft Visio (Advanced), Microsoft Excel (Good), Microsoft Outlook (Advanced), Microsoft PowerPoint (Advanced).</p>

**Publications**

Co-author: Ewall-Wice, A. et al., “The Hydrogen Epoch of Reionization Array Dish II: Characterization of Spectral Structure with Electromagnetic Simulations and its Science Implications.” (MIT, Cambridge, Stellenbosch University, NRAO, SKA SA, Berkeley UC, Washington Univ., Penn Univ. etc.)  
<http://iopscience.iop.org/article/10.3847/0004-637X/831/2/196>

Lead author, submitted for approval to IEEE RADIO Conference: Venter, M., Bolli, P., “Electromagnetic Modelling of the 32-m Ghana Radio Telescope”, May 2017

**I N A F**  
**Istituto Nazionale di Astrofisica**  
OSSERVATORIO ASTROFISICO DI CAGLIARI  
Via della Scienza, 5 - 09047 SELARGIUS (ITALIA)  
Tel. + 39 070 711801

Cagliari, Jun. 27, 2017

To: Mariet Venter – SKA South Africa

**Invitation Letter for Mariet Venter**

Dear Mariet,

In order to continue and increase our scientific collaboration on microwave holography for the African VLBI Network (AVN), I would like to invite you to spend 1 or 2 weeks at the INAF - Cagliari Astrophysical Observatory, Via della Scienza, 5 – Selargius, Italy during the next holographic campaign at Sardinia Radio Telescope (SRT), which will be carried out by December 2017.

Participating closely in a microwave holography campaign would be an excellent opportunity to deal with the various topics connected to microwave holography for AVN as well as for the INAF. It is well known that microwave holography is a key-tool for mapping the deformations of primary mirrors of large radio telescopes. However, its application requires a lot of effort since it involves several disciplines and therefore, sharing experience among different Institutes would be extremely helpful.

However, it is understood that this invitation does not commit INAF - Cagliari Astrophysical Observatory to any financial support.



Emilio Molinari

Director of the Astronomical  
Observatory of Cagliari