The Photoconductive Antenna
a new device for spacegeodesy

Stefan Riepl, Christian Plötz (BKG)
Reinhard Zeitlhöfler (TUM)
Axel Nothnagel (UB)

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### Origin and basic idea

- terahertz generation and detection
- terahertz spectroscopy (body scanner)
- link between VLBI and SLR
- applicable for local survey
- intersystem time transfer

<table>
<thead>
<tr>
<th></th>
<th>VLBI</th>
<th>Terahertz Frequency Domain</th>
<th>SLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency/Hz</td>
<td>1E9</td>
<td>1E14</td>
<td></td>
</tr>
<tr>
<td>Wavelength/m</td>
<td>1E–1</td>
<td>1E–6</td>
<td></td>
</tr>
</tbody>
</table>
What is a PCA?

- Metal-Semiconductor-Metal Contact
- GaAs or InGaAs LT grown structures
- Single and multi gap (interdigital) layout
- Fiber coupling available
- Excitation threshold ca. 0.1nJ
- Directivity via Si ball lens
- Bidirectional device
First Experiment

- 60 degree emission angle
- Linear polarization
Electrical Spectrum

- Repetitive signal
- Frequency dependence $\exp((\omega \tau)^2/2)$
Phase Noise

**R&S FSUP Signal Source Analyzer**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Residual Noise [T1 w/o spurs]</th>
<th>Phase Detector +40 dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Frequency: 73.014999 MHz</td>
<td>Int PHN (1.0..3.0 M) -48.8 dBC</td>
<td></td>
</tr>
<tr>
<td>Signal Level: -26.43 dBm</td>
<td>Residual PM 0.294 °</td>
<td></td>
</tr>
<tr>
<td>Cross Corr Mode: Harmonic 1</td>
<td>Residual FM 1.409 kHz</td>
<td></td>
</tr>
<tr>
<td>Internal Ref Tuned: Internal Phase Det</td>
<td>RMS Jitter 11.1672 ps</td>
<td></td>
</tr>
</tbody>
</table>

**Phase Noise [dBc/Hz]**

**Running ...**

Date: 21.APR.2011 14:53:48
Peak Flux Calculation

- 1Jy sources are detected by VLBI within reasonable observation time
- Current setup limits acceptance angle to 5 degree

<table>
<thead>
<tr>
<th>PCA distance</th>
<th>73MHz/0.1nJ D=1cm, 10'', 60°</th>
<th>1kHz/1mJ D=1cm 10'' / 60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>50m</td>
<td>2E9 Jy</td>
<td>1E16 Jy</td>
</tr>
<tr>
<td>300km</td>
<td>1E-6 Jy</td>
<td>15 Jy</td>
</tr>
<tr>
<td>1000km</td>
<td>1E-8 Jy</td>
<td>0.1 Jy</td>
</tr>
<tr>
<td>20000km</td>
<td>1E-13 Jy</td>
<td>1E-6 Jy</td>
</tr>
</tbody>
</table>
PCA is an optical to microwave transceiver

PCA is a good replacement for the current VLBI phase cal device

Combination of PCA with Laser Reflector would give a good beacon for combined laser and microwave ranging

Intersystem (SLR->VLBI) time transfer may be used to detect biases