ALOHA@CHARA
Experimental developments

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Summary

• In-lab:
  • High fringe contrast with black body source in L band
  • Multi-channels mode in H band

• On site:
  • OPD Stability test for fiber links
In lab:
High fringe contrast with black body source in L band in photon counting regime

Objectives:
Test the repeatability of the SFG process
Experimental setup

~100 pW/nm @ 3.4 µm

[Diagram of experimental setup with labels such as "verre fluoré SM fibre", "CaF$_2$ lens", "thermal source", "OAP", "BS", "M", "D", "L1", "L2", "L3", "SFG stage", "NIR stage", "MIR stage", "fibre delay line", "phase modulator", "fibre coupler", "grating", "monochromator", "photon counter", "normalized spectrum", "convected wavelength (nm)", "Am1", "Am2", "FWHM=0.3 nm", "FWHM=1.5 nm".]
Visibility function

- New non-linear components with AR coating could improve:
  - Conversion efficiency
  - Contrast

\[ C = 90\% \text{ w/ monochromator} \]
\[ C = 75\% \text{ w/o monochromator} \]
In lab:
Multi-channels spectral mode in H band

Objectives:
Simultaneously study multiple spectral channels with ALOHA

**Principle**

**Single channel**
- Single pump
- Single spectral sample

**Multichannel**
- Multiple pumps
- Multiple spectral samples

The CHARA Array Science Meeting 2018
Data Process

Pump number | Spectral sampling | Pump phase | Fringes frame | PSD
---|---|---|---|---
1 | \( B_{s1} \) | \( B_0(v_s) \) | \( S_1 \) | \( f \)
i | \( B_{s1} \) | \( B_0(v_s) \) | \( S_i \) | \( f \)
N | \( B_{sN} \) | \( B_0(v_s) \) | \( S_N \) | \( f \)
\( \Sigma \) | \( B_{s1} \) | \( B_0(v_s) \) | \( S_i \) | \( S_N \) | \( f \)
Experimental setup

<table>
<thead>
<tr>
<th>Sample</th>
<th>$\lambda_s$ (nm)</th>
<th>$\lambda_p$ (nm)</th>
<th>$\lambda_c$ (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1554.0</td>
<td>1062.6</td>
<td>631.08</td>
</tr>
<tr>
<td>2</td>
<td>1551.6</td>
<td>1063.9</td>
<td>631.14</td>
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</tbody>
</table>

On sky test:
- Bad conditions (2016 & 2017)
- New attempt in 2018
On site:
Stability test for telescope fiber links
Out-door setup

Long term objective:
• Using optical fiber for lossless, polarization controlled, long distance light transport

Problem: Fiber length stability

Solution:
• Measure the OPD drift,
• Stabilized the OPD,

in a representative context
Servo control

Calibration in open-loop

In closed-loop:

- Correction signal $V_{corr}$ gives the OPD drift
- Error signal $\epsilon$ gives the stability
Results

ODP Drift:
Compatible with fiber delay line

Stability:
Compatible with Interferometry!
Short term perspectives

• New nonlinear component with AR coating for L band

• On-sky sensibility test in L band @ C2PU (Observatoire de la côte d’Azur) before implementation on the CHARA array
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