Community Access Time
and
Visibility Calibration

Gail Schaefer

The CHARA Array of Georgia State University

Mount Wilson, CA
Open Access Time at CHARA

- Initiated an open access program at CHARA
  - Supported by NSF/MSIP award
- Community access to telescope time
- Provides 50 nights/year over next four years
- Time allocated through NOAO TAC:
  - Proposals due at the end of March and September
  - Next deadline is April 2 (for time in Aug-Dec)
- User-friendly database of archival data
  - Jeremy's talk yesterday
Average over-subscription rate ~ 2.2
Community Access Statistics

- 2017B
  - 6 accepted proposals (low mass stars, exoplanet hosts, binaries)
  - 4 PI's former CHARA consortium members at new institutions
  - 2 PI's new to CHARA

- 2018A
  - 9 accepted proposals (low mass stars, exoplanet hosts, binaries, novae)
  - 4 PI's former CHARA consortium members at new institutions
  - 5 PI's new to CHARA
Support for Community Access Programs

- Visitor Support Scientist: Gail Schaefer
- Data Scientist: Jeremy Jones
- Observational Assistance: Chris Farrington, Robert Klement, Norm Vargas, Olli Majoinen

- Provide help with planning and taking observations
- Provide calibrated OIFITS files
While processing data for an NOAO program that used CLASSIC .......
While processing data for an NOAO program that used CLASSIC ........

........ I encountered unexpected scatter in the visibilities ........
While processing data for an NOAO program that used CLASSIC ......

...... I encountered unexpected scatter in the visibilities ......

Started looking into different methods for calculating visibilities. Used sample data on HD 128167 (Boyajian et al. 2012).
For a single observation...
Fringe Weights

High Weight
\[ V^2 = 0.31 \]
\[ w = 22 \]

Low Weight
\[ V^2 = 0.07 \]
\[ w = 8 \]
Weight vs. Visibility
Weight vs. Visibility
New Strategy for redfluor: Compute Weighted Means
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- Edit scans by fringe weight
  - $E[min\_weight]$  
  - Risk of biasing data
- Number of standard deviations for outlier removal
  - $o[n\_sigma]$
New Strategy for redfluor: Compute Weighted Means

- Edit scans by fringe weight
  - E[min_weight]
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- Number of standard deviations for outlier removal
  - o[n_sigma]

- Compute weighted mean
  - New default in redfluor
  - Turn off using -M flag
New Strategy for redfluor: Compute Weighted Means

- Edit scans by fringe weight
  - $E[\text{min} \_ \text{weight}]$
  - Risk of biasing data

- Number of standard deviations for outlier removal
  - $o[n \_ \text{sigma}]$

- Compute weighted mean
  - New default in redfluor
  - Turn off using -M flag
Analysis from Boyajian et al. (2012)

\[ \theta = 0.841 \pm 0.013 \text{ mas} \]
Comparison of Results

Analysis from Boyajian et al. (2012)

Quick reduction using median visibilities

\[ \theta = 0.841 \pm 0.013 \text{ mas} \]

\[ \theta = 0.825 \pm 0.039 \text{ mas} \]

\[ \text{rms} = 0.27 \]

Note: Uncertainties scaled to force \( \chi^2 = 1 \)
Comparison of Results

Analysis from Boyajian et al. (2012)

Quick reduction using median visibilities

Quick reduction using weighted mean visibilities

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Note: Uncertainties scaled to force $\chi^2 = 1$
Comparison of Photometric and Interferometric Measurements

- Comparison of photometric and interferometric Teff
- Systematic trend in at smallest diameters
- Teff for small diameters ($\theta < 1$ mas with CLASSIC) are hotter by as much as 100-400 K

Casagrande et al. (2014)
Comparison of Measurements From Different Combiners

T. White et al. (submitted)
Comparison of Photometric and Interferometric Measurements

HD 128167

Boyajian et al. (2012)

Casagrande et al. (2011)

Effective Temperature (K)

6500 6600 6700 6800 6900

Weighted Mean
Comparison of Photometric and Interferometric Measurements

HD 128167
- Boyajian et al. (2012)
- Casagrande et al. (2011)
- Weighted Mean

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- Boyajian et al. (2012)
- Casagrande et al. (2011)
- Weighted Mean
- PAVO: Bazot et al. (2011)
Computing weighted means is currently the default option for redfluor.

V2_SCANS visibility estimator

This can be turned off using the -M flag.

redfluor -V

VERSION: V3.1 Wed Feb 28 14:48:15 PST 2018
Summary

• Updates to redfluor code (CLASSIC)
  – Weighted means is currently the default option for redfluor
  – Warm shutters and sky backgrounds [Theo's talk yesterday]

• Possible steps for the future – look into uncertainties
  – Standard deviation overestimates scatter in observations
  – Standard error underestimates scatter in observations