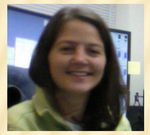
# Fundamental Properties of Low Mass Stars with Long Baseline Optical/Infrared Interferometry



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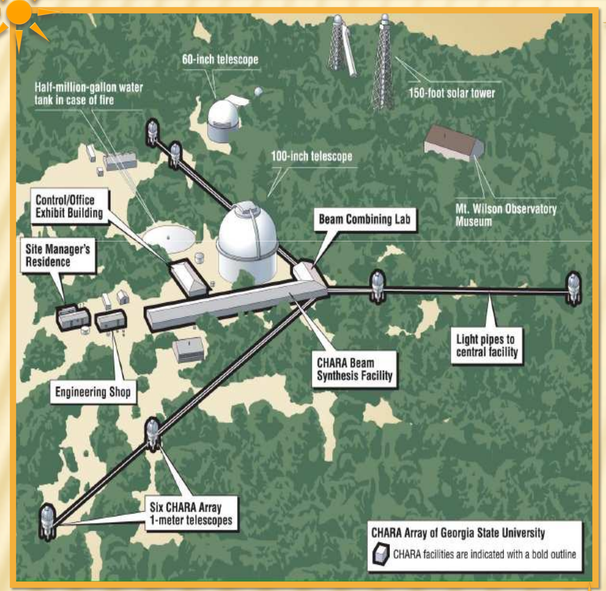
We present preliminary measurements of fundamental astrophysical properties of nearby, low-mass, K- and M-dwarfs. The principal goal of our study is the determination of linear radii and effective temperatures for these stars using the CHARA Array for the interferometric measurements of the angular diameters. We further present robust bolometric flux measurements that incorporate available photometry from the literature. We investigate the discrepancy seen between theoretical and observed stellar radii, which seem to be related to stellar activity, metallicity, and possibly convection in these late-type stars. Understanding the source of this disagreement is likely to impact other areas of study for low-mass stars, such as the detection and characterization of planets orbiting these objects in the habitable zones.




## METHOD

◆The angular diameter, θ, is directly measured from interferometry (see figure below)

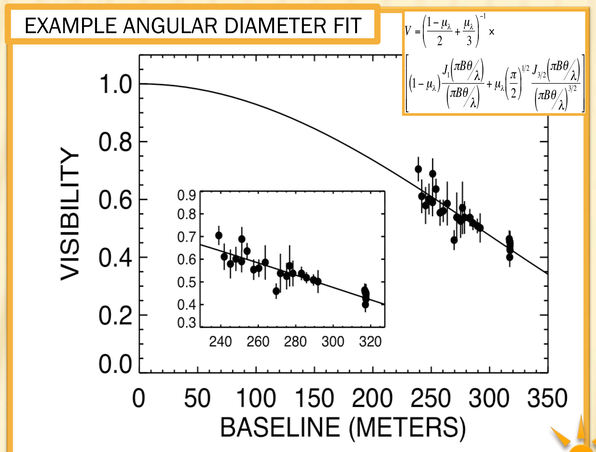
◆The luminosity (L=f[$F_{BOL}$, π]), temperature (T=f[θ,$F_{BOL}$]), and radius (R=f[θ,π]) are determined to high accuracy (σR/R~3%, σT/T~1-2%)

## OBSERVATIONS

◆Interferometric observations with the CHARA Array in K- and H-band using the CHARA Classic beam combiner

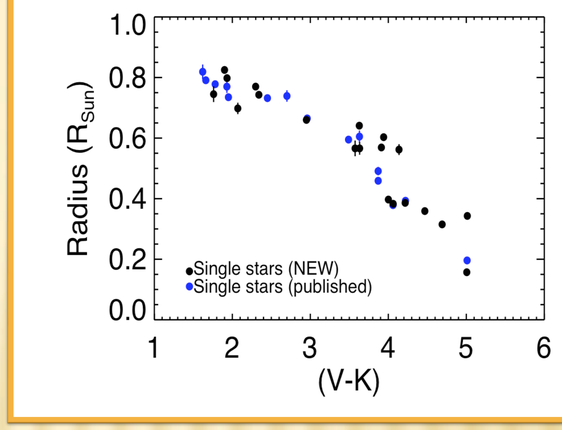
◆The sample consists of K0-M5.5 dwarfs, complete out to ~6.5 parsecs, limited by *V* mag and declination >-10°.

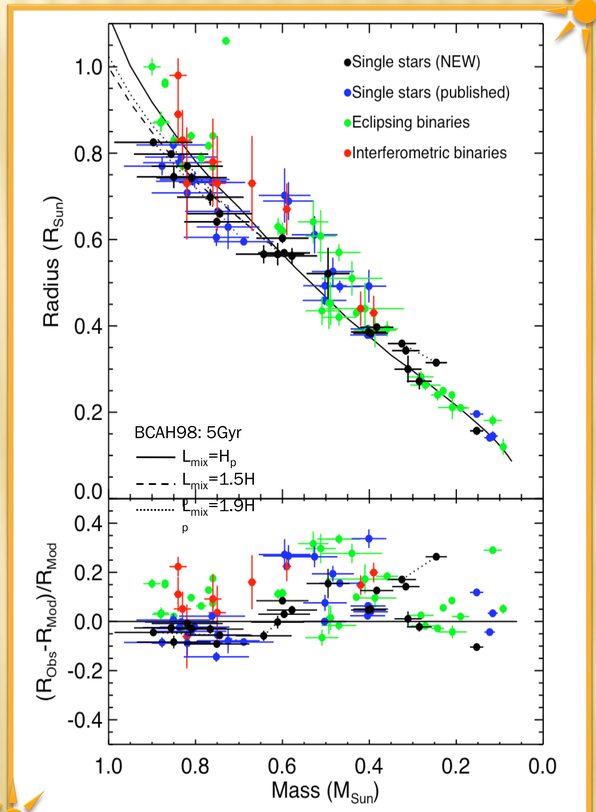
EXAMPLE ANGULAR DIAMETER FIT




Current tally of diameters measured with interferometry with better than 5% accuracy

| | Published | THIS WORK |
|---|---|---|
| K- stars | 8 | 8 |
| M-stars | 9 | 14 |
| TOTAL | 17 | 22 |



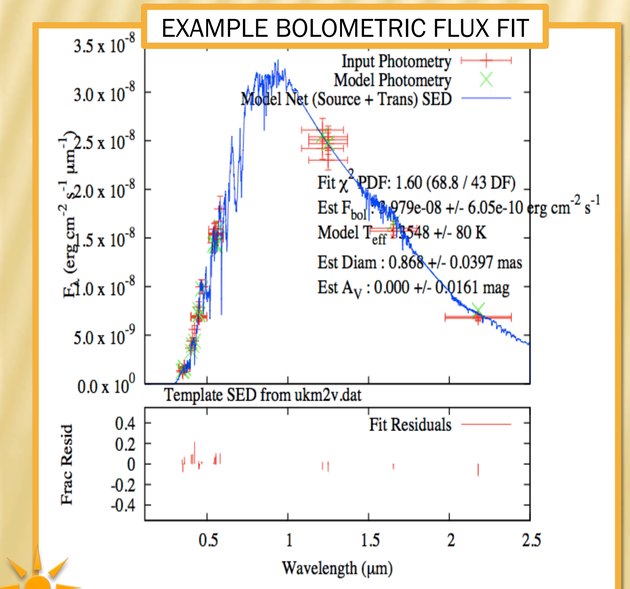

## RESULTS

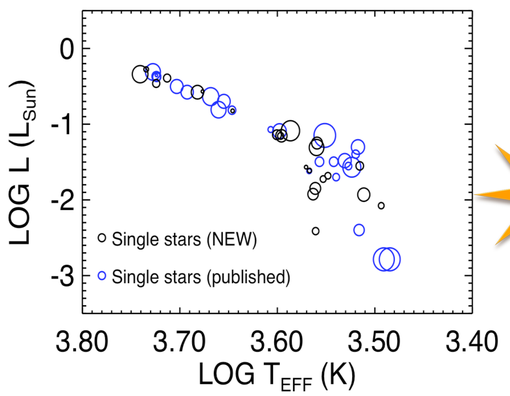
◆Twenty-two NEW observations of K-M dwarfs: 0.5<θ<2.0 mas: 0.15<R<0.9 $R_\odot$: Mean σR≈2.5%, σT≈1.3%

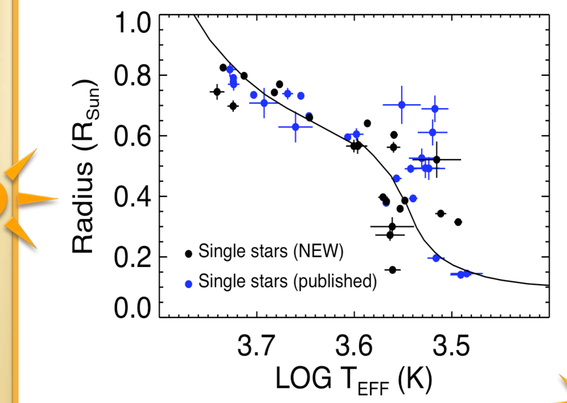
◆The observed radii of M-type (mass<0.6$M_\odot$) dwarfs are offset from models by ≈12%. The introduction of these new data shows that neither the metallicity or the activity can provide suitable explanation to this discrepancy as originally thought.

◆Directly obtained empirical evidence of the "kink" due to H2. Is it significant or just coincidental that this transition occurs at same place where models fail to predict radii?

EXAMPLE BOLOMETRIC FLUX FIT




RADII OFFSETS: SINGLE STARS <0.6$M_\odot$

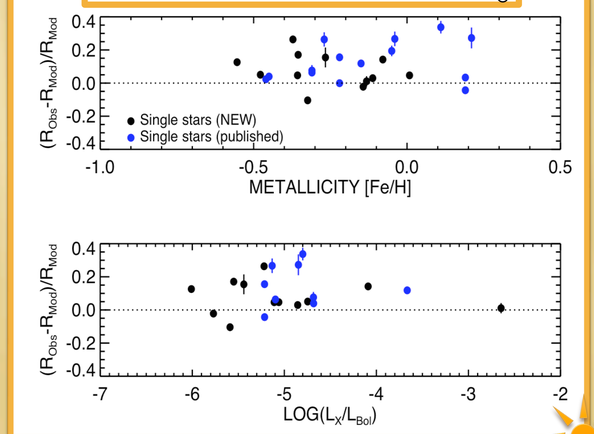



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**FIGURE NOTES:** Masses for single stars are derived from the K-band M-L relation from Delfosse et al. 2000, and assume a 10% error. Stars in wide visual binaries where both components are resolved with interferometry are connected with dotted lines (top-right).
References for single star radii: Lane et al. 2001, Ségransan et al. 2003, Berger et al 2006, Boyajian et al 2008, Kervella et al. 2008, Demory et al. 2009: binary star radii pulled from Torres et al. 2009.