P-L relations for AGB stars

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Outline

- Overview of variability in AGB stars
- My current results
- Future directions / connections to mass return
Evolution along the AGB

- Medium mass stars (~1-8 $M_\odot$)
- Post core-He burning, star powered by concentric H and He shells
- Hydrodynamic instabilities in the stellar envelope lead to pulsations on a timescale of ~10-100 days.
P-L sequences

- Variable evolved stars follow clear P-L relationships
- ~25-30% exhibit Long Secondary Periods (LSP)

From Nie et al. 2010
What are LSPs?

- Not radial pulsation
  - Periods much longer than the fundamental mode
- Not binarity
  - Two recent papers (Nicholls et al. 2009, Nie et al. 2010) rejected this hypothesis
- But ARE associated with mass loss
  - Wood & Nicholls 2009
IR P-L relations

- IR photometry from the SAGE survey (Meixner, et al. 2006) and variability data from MACHO (Fraser et al., 2005, 2008)
- Largest multi-wavelength analysis of its kind, ~30,000 sources with 8 bands of near and mid-IR photometry (J-24μm)
Sample size and wavelength coverage has revealed new features of AGB star P-L relations:

- Evidence of non-linearity in P-L relationships at a given wavelength
- AGB stars at different evolutionary stages show different trends in slope as a function of wavelength.
Future Directions

- GRAMS AGB RT model grids nearing completion (Srinivasan (2010) in prep, Sargent (10 minutes))
  - Will allow accurate mass-loss rate estimates on a star by star basis
- Detailed comparison to stellar population models (i.e. Marigo, et al. 2008)
  - Integrated mass-return history of the LMC!
References

Nie et al., 2010, AJ, 139, 1909