Impact of UV imaging on the detectability of unresolved binaries

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Spectral energy distributions

A tool to detect and characterise unresolved binaries

- Wide multi-wavelength coverage
- Availability of wide field surveys
- Inexpensive to obtain data

$$F(T,R,D,\lambda) = \left(\frac{2hc^2}{\lambda^5}\frac{1}{exp\left(\frac{hc}{\lambda kT}\right)-1}\right)\left(\frac{R}{D}\right)^2$$

$$F_{noisy}(T,R,\sigma,\lambda) = F(T,R,\lambda)\times(1+\mathcal{N}(0,\sigma^2))$$

$$F_{bin}(T_1,T_2,R_1,R_2,\lambda) = F(T_1,R_1,\lambda)+F(T_2,R_2,\lambda)$$

$$F_{bin,noisy}(\sigma) = F_{bin}\times(1+\mathcal{N}(0,\sigma^2))$$

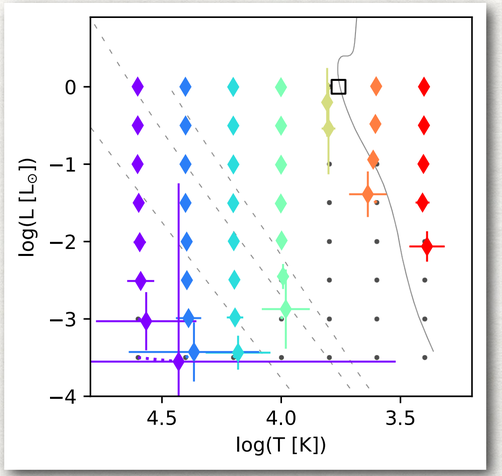
Binary Modelling

- Stars are modelled as pure blackbodies
- *F(stellar_parameters, noise, filter_system)*

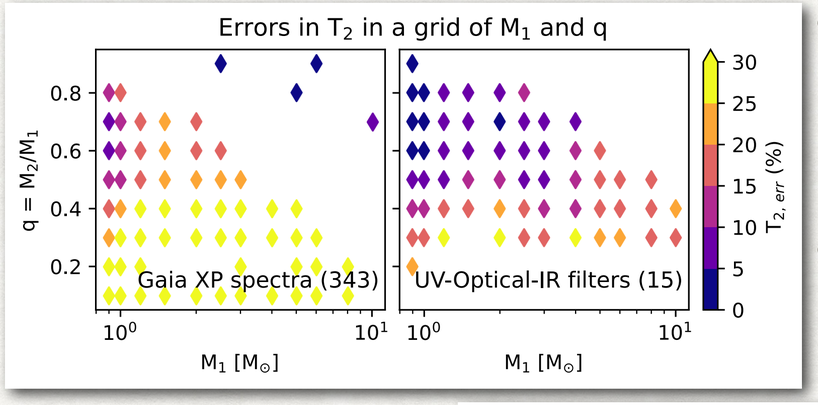
See more: *https://github.com/jikrant3/sed-analysis-tools*

Recoverability across the HRD

- A grid of secondaries for various primaries using 15 UV-IR filters.
- Compared the I/O HRD positions
- At 1% flux precision, a wide range of HRD is recoverable.
- Fails for similar T_{eff} binaries and faint (L_1/L_2>1000) secondaries

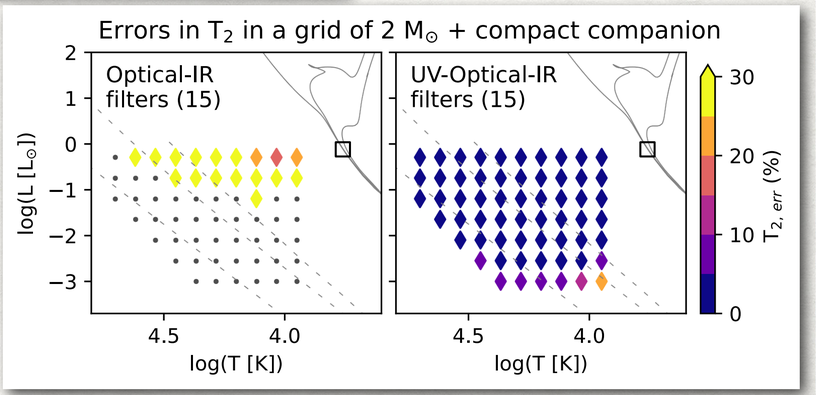


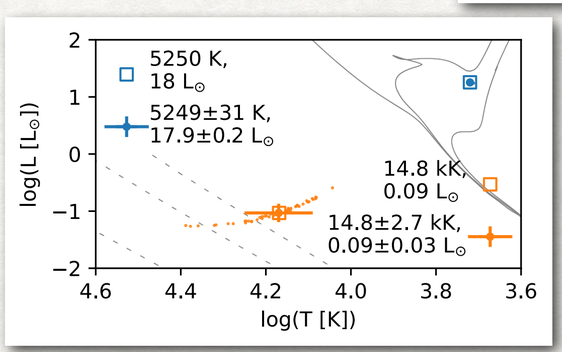
Importance of UV data for detectability



- Only a small fraction of unresolved binaries can be disentangled using Gaia XP spectra
- UV-IR data dramatically increases the accuracy

- Two sets of binaries observed with UV-IR and Opt-IR filters
- Opt-IR: only brightest (L_1~L_2) compact objects detectable





Estimating fitting errors

- Tool to calculate blackbody based SED parameter errors
- Lower bounds to the actual errors because of simple model & noise