New catalogue of Pre-Main Sequence objects using Gaia

Miguel Vioque University of Leeds

R. D. Oudmaijer (University of Leeds, UK), M. Schreiner (Desupervised, Denmark), D. Baines (ESAC, Spain), and R. Pérez-Martínez (Isdefe, Spain)



Gaia's view of Pre-Main Sequence Evolution, Leeds, 20th of June 2019

Looking for new Pre-Main Sequence (PMS) objects in Gaia!





Main characteristics of PMS objects:

- Infrared excesses
- Hα emission
- Photometric variability

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Class II -

Perform an homogeneous selection, distance and position independent!

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We used a Neural Network for this:

Selection of the characteristics:

- From Gaia: *B_p*, *G*, *R_p* and 2 variability indicators
- From AllWISE: *J*, *H*, *K*_s, *W*1, *W*2, *W*3, *W*4
- From IPHAS & VPHAS+: $r H_{\alpha}$

Distance and position independent!

Remove all linear dependency

Create all possible colours



Cross-match Gaia DR2 x AllWISE x IPHAS and VPHAS+

Input Sample = 4,151,538 sources

Construction of the **Training Set**:

- 848 Pre-Main Sequence objects
 - 163 are Herbig Ae/Be stars (high mass end, all available)
- **775** Classical Be stars (all available).
- **471,111** random sources with all the characteristics.

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I/_____ Training the Neural Network

Input Sample = 4,151,538 sources

Trained Neural Network

Probability Map







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This algorithm cannot assess itself, we need a **totally independent** analysis

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3131 potential Herbig Ae/Be (682 with good Gaia solution)











Spatial distribution



Within 1.5 Kpc

All (up to 5 Kpc)

0°

Spatial distribution



Within 1.5 Kpc



All (up to 5 Kpc)

Mid-IR excess vs. Mass (lower limits)



Variability vs. Mass (lower limits)



Variability vs. Mass (lower limits)



Vioque et al. 2018



Cody & Hillenbrand, 2018







Results:

- We retrieve 8470 new PMS candidates. 3131 (682) potential Herbig Ae/Be stars.
- We retrieve 693 new Classical Be stars candidates.
- We retrieve **1309** candidates of belonging to either one of the two categories.



Near- and mid- infrared excesses are the most important characteristics followed by Hα and variability which are equaly important