Mining the sky for accreting T Tauri stars outside star-forming region cores

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Characteristics of investigated targets?

This population is extremely rare. Few sources (TW Hya, HEN 3-600A, TWA 14, TWA 30A and B, TWA 31, HD 319139, TYC4496-780-1) are known. The typical properties of accreting T Tauri stars are:

- be a X-ray emitter;
- display a near- and far-infrared excess;
- a large Hα line width and;
- a high-lithium content.

Selecting an appropriate sample of targets is still the major difficulty in such studies.
We selected the optical counterparts of RASS/XMM-Slew surveys X-ray sources cross-matched with 2MASS point sources over all the sky.

- "multivariate analysis" for separating the different classes of X-ray emitters and selecting the most probable late-type young stars with active coronae;
- good identification of active young stars down to V=18 mag;
- construction of the largest sample of stellar X-ray sources: the RASS-Stars catalogue (RSC).
The correlation of RSC and AKARI catalogues allowed us to identify about 100 sources showing an IR excess, including TW Hya and TYC 4496-780-1. That makes us confident on the effectiveness of our selection method.

After a study of their bibliographic data, we only selected 13 sources observable from the northern hemisphere (Sophie@OHP, Hermes@Mercator).
RSC/AKARI candidates: Results

We discovered 5 (~40%) likely accreting T Tauri stars in the field, with an age of ~10 Myr or younger.

Only RJX0330 was already known as a YSO from Spitzer observations.

Note the strong temporal variability of the Hα profile of RXJ0550. That is a phenomena often observed in accreting T Tauri stars.
We used WISE color-color and color-magnitude diagrams to extract a subsample of TTS candidates with no reference in the literature.
For the observing run in October 2012 with IDS@INT, we selected 25 sources from the area A. Finally we found:

- 17 young stars (both classical and weak-line TTS) => ~70% of targets;
- 2 new binary systems;
- 1 possible triple system near ε Ori. The primary was only identified because of its IR excess;
- several good candidates;
- 2 stars also display an emission of the He line.
Candidates selected from the area B

All the sources selected for the observing run in October 2012 with IDS@INT seem to be M giant sources, with a fairly similar spectral type.
All “isolated” accreting T Tauri stars belong to one of young associations (6 of TWA, 1 each of β Pic and Cepheus associations). The discovery of new ones offers the opportunity to search for any new concentration of young stars.

Looking for the presence of additional young stars in the sky area surrounding TYC 4496-780-1, we found the first young association of the northern hemisphere (northward of δ = +30 deg).


![Diagram](image-url)
Conclusions & Perspectives

- Construction of the largest and homogeneous sample of stellar X-ray sources using statistical multivariate analysis methods:
  - good identification of active young stars down to $V = 18$ mag.

- Cross-correlation of RSC and AKARI catalogues:
  - Identification of about 100 candidates, but many are already known;
  - Discovery of 5 T Tauri stars (age = 5-10 Myr) probably still in their accretion phase from a circumstellar disc among the 13 sources observable from the northern hemisphere.

- Cross-correlation of RSC and WISE catalogues (= ongoing project):
  - Discovery of about 20 additional young stars, including several accreting T Tauri star candidates.

- Possibility to discover new associations of young stars?
  - e.g., as around TYC 4496-780-1 (Klutsch et al., in prep.).

- The next step is to perform the same kind of analysis on the release of the Galaxy Evolution Explorer (GALEX) survey.
  - e.g., Discovery of TWA 31 (Shkolnik et al., 2011, ApJ, 727, 6)
Thanks for your attention