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Konkoly optical catalog of young stars for the Gaia Photometric Science Alerts

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Abstract. Our aim is to present a new and so far most complete catalog of optically selected young stars. The basis of this work is an extensive literature search for young stars in all the known nearby (< 2 kpc) star forming regions, included in the Handbook of Star Forming Regions Reipurth (2008a,b), and in 67 additional catalogs. We collected data on known young, pre-main-sequence stars detected in optical bands. The catalog contains the celestial coordinates, object names, names of the enclosing star forming region, identification methods, distances, and other information (e.g., references, binarity) for 15208 young stellar objects. It is already in use by the Gaia Photometric Science Alerts Team to identify variable young stars in the Gaia data. Our catalog was cross-correlated with the Gaia DR2 and we obtained flux and distance estimations for 86% of the stars.

Keywords. catalogs, stars: pre–main-sequence, techniques: miscellaneous

The Gaia Photometric Science Alerts† is an all-sky photometric transient survey, based on the measurements of the Gaia space observatory (Gaia Collaboration *et al.* 2016). The team, responsible for the alerts, runs a dedicated data processing pipeline to look for transient events in the Gaia data and alert immediately if there are noticeable changes in brightness of detected stars.

During the alert identification the objects are classified into basic transient types (e.g., supernova, cataclysmic variable, young stellar object), and the alerts are published online to promote follow-up observations. This identification process is not very effective when it comes to young stars, as it is optimized for transient detection (e.g., supernovae). In contrast, the variability patterns of young stars are quite diverse, and more complex algorithms are needed for an efficient event detection. In order to support the more efficient detection and classification of variable young stars among the alerts, we compiled a catalog of optically confirmed young stellar objects (YSOs), which is so far the most complete catalog of this kind. There are some other YSO catalogs existing like Marton *et al.* (2016) or Tóth *et al.* (2014), but most of them on the one hand, call their sources only YSO candidates since there are serious amount of contamination and uncertainty in the classifications on the other hand, these based on infrared detections and many of the sources do not have optical counterparts. In contrast, our catalog includes known young stars, primarily identified at optical wavelengths, from numerous literature sources: 67 individual catalogs and the two volumes of the Handbook of Star Forming Regions Reipurth (2008a, 2008b).

We collected the YSO lists from the original catalogs, and loaded them into a database using a common data format. Then we removed the duplicates using a 1.5 arcsec searching

† http://gsaweb.ast.cam.ac.uk/alerts

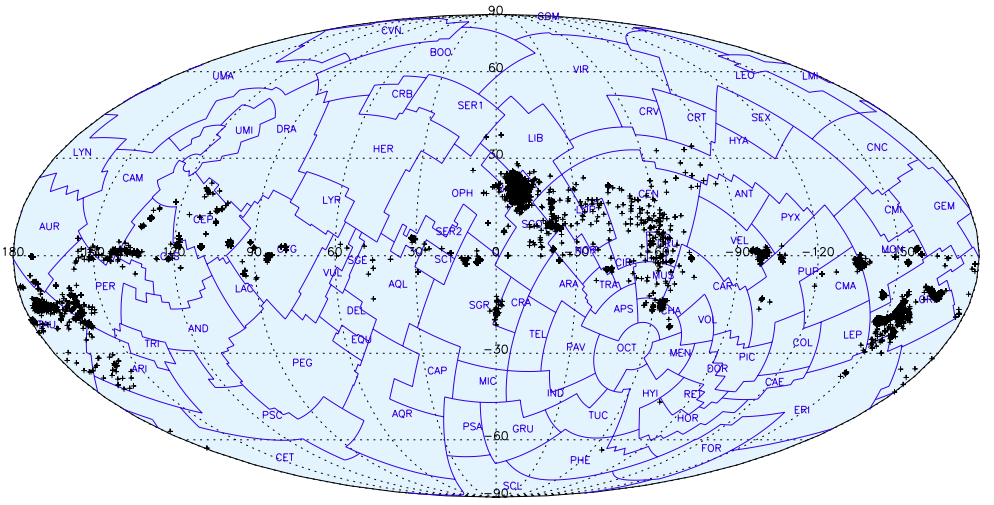

Figure 1. Full sky map of the objects from the Konkoly optical catalog of young stars. The background map shows the boundaries of the constellations.

radius, and flagged the known multiple systems. The catalog contains the object names, celestial coordinates, names of the embedding star forming region, identification methods, references, and binarity flags for 15208 YSOs, which are all confirmed young stars. Fig 1 shows the positions of the sources on the galactic sky.

We cross-correlated our catalog with the Gaia Data Release 2 (DR2), Gaia Collaboration *et al.* (2018). As a result, our catalog also contains optical (mean G) magnitudes for 87% and distance estimates for 79% of the objects. The catalog is already in use in the form presented here by the Gaia Photometric Science Alerts Team to help identify YSOs among the many variable sources picked up by the alert algorithm. Nevertheless, we constantly keep the catalog up to date until we publish it soon.

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