# A fresh look at the 3-5 Myr-old ε Cha association

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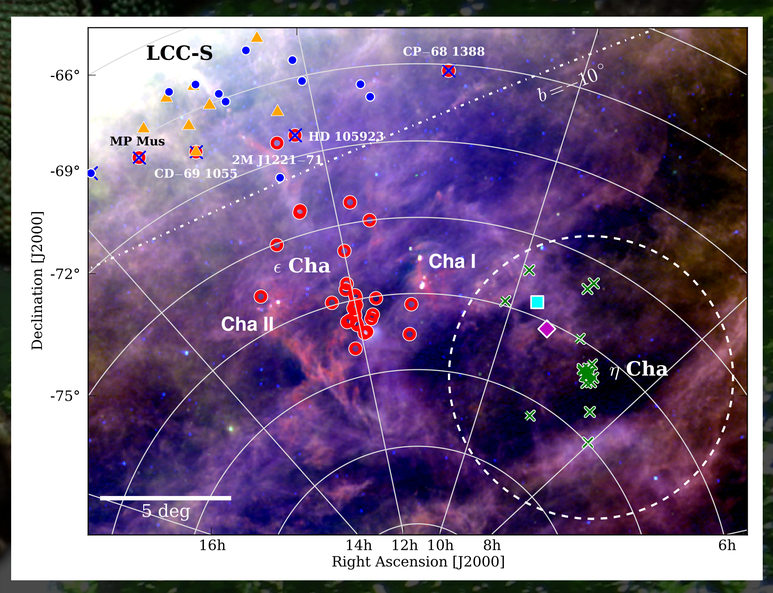
## Motivation

**Despite being an ideal laboratory to study circumstellar disc evolution around low-mass stars, the ε Chamaeleontis association remains one of the least-understood young moving groups in the solar neighbourhood. Our work aims to improve the membership, kinematics and age of ε Cha, investigate its disc and accretion properties and its relationship to the nearby benchmark open cluster η Cha.**



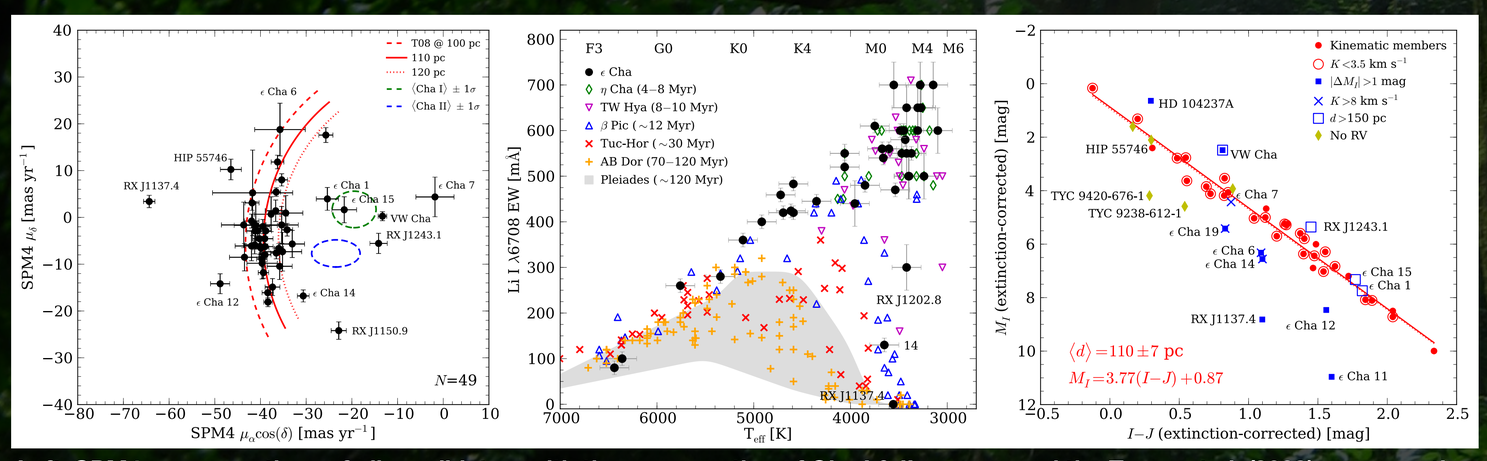

***IRAS colour image of the Chamaeleon region with members of ε Cha (red circles), the open cluster η Cha (green crosses) and the LCC subgroup of Sco-Cen (blue circles, crosses, gold triangles).***

## Updated membership

There are several definitions and over 50 members of the ε Cha/Cha-Near association proposed in the literature. A quarter lack radial velocities vital for confirming membership in a moving group. To clarify this confusing picture we collated the best-available photometry (2MASS, DENIS, extinctions), proper motions (*Hipparcos*, Tycho-2, SPM4; **left figure**) and spectroscopy (spectral types, RVs, lithium; **middle figure**) for these stars, including new ANU 2.3-m/WiFeS multi-epoch spectra.

We then applied an iterative kinematic and colour-magnitude analysis **(right figure)** to simultaneously define and test the membership of ε Cha. Our final solution **(top right)** comprises 35 (confirmed**)** to 41 (provisional) members of spectral types B9 to mid-M at a **mean distance of 110±7 pc**. This is double the canonical membership of Torres et al. (2008), primarily due to our expanded RV sample. ε Cha includes four stars previously attributed to the Lower-Cen-Cru subgroup of the Sco-Cen OB association (**including the accretor MP Mus**), a new **0.14 pc** separation M0+M0 wide binary and several new spectroscopic binaries. We rejected 11 stars proposed as members in the literature. They likely belong to the background Cha I and II clouds and other nearby young groups.

**We emphasize the importance of a *holistic* (kinematic, photometric, spectroscopic) and *conservative* approach to assigning young stars to kinematic groups, many of which have only subtly different properties and ill-defined memberships.**

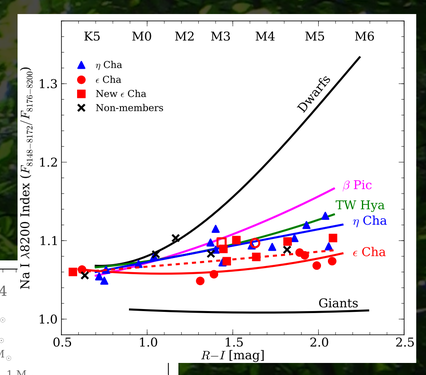


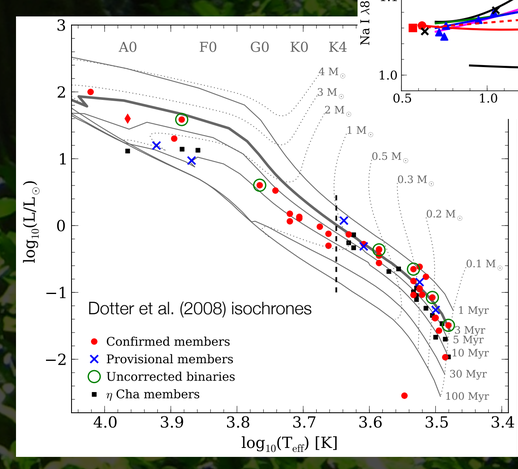

***Left:** SPM4 proper motions of all candidates, with the mean motion of Cha I & II sources and the Torres et al. (2008) space motion (red lines). Several outliers and Cha cloud members are apparent. **Middle:** Candidate Li I λ6708 EWs compared to other young groups from da Silva et al. (2009). ε Cha has a lithium age similar to the open cluster η Cha. **Right:** ε Cha CMD from the membership analysis (w/ kinematic distances) and the 12 candidates not initially selected as members (blue squares, crosses).*

## Age

Lack of significant lithium depletion and comparison to theoretical isochrones **(below)** shows that ε Cha has a **median age of 3-5 Myr**, distinguishing it as the youngest moving group in the solar neighbourhood and the only one associated with remnant molecular material. We find no evidence for a large (>2 Myr) intrinsic age spread. Although commonly cited as co-eval, a differential HRD, CMD and gravity analysis **(below)** demonstrates that **ε Cha is 1-3 Myr younger than the nearby open cluster η Cha** (4-8 Myr, 94 pc).

***Below:** HR diagram of confirmed and provisional ε Cha members. Both the high (<F sp. type) and low-mass (mid-K-M) members are consistent with a median age of 3-5 Myr.*




***Above:** Gravity (age) sensitive Na I λ8200 index values from Lawson et al. (2009, solid lines) and our own observations. ε Cha is a few Myr younger than η Cha in such a diagram.*

## Circumstellar discs



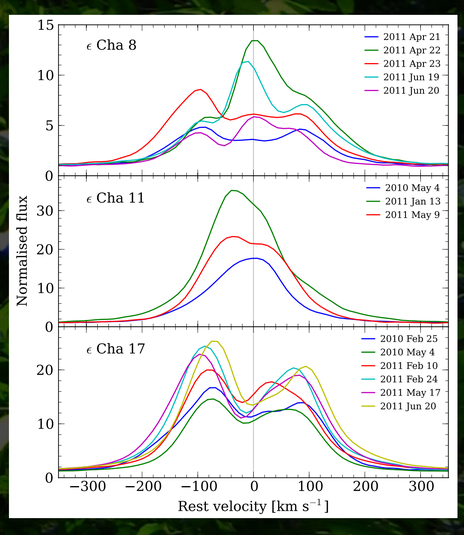

Fifteen ε Cha members have 2MASS/WISE SEDs attributable to circumstellar discs. As expected of a young, rapidly-evolving population they show a variety of morphologies, from optically-thick accretion discs to weak-excess debris discs. **We derive a disc fraction of $29^{+8}_{-6}$ %.** This is typical of a 3-5 Myr-old population **(left)** and casts doubt on the recent claim by Fang et al. (2013) that disc evolution proceeds more slowly in sparse associations.

***Top:** <8 μm disc fractions of several star-forming regions and associations (see Fang et al. 2013). ε Cha's updated disc fraction (29%) is no longer unusually high for its age. **Bottom:** 2MASS/WISE SEDs of two new Class III discs in ε Cha.*

## Accretion

Eleven members with disc excesses are classified as accretors based on their Hα emission strength, including three stars **(right)** which exhibited multi-component, variable profiles. Their Hα velocity widths imply mass accretion rates of $10^{-10}$-$10^{-8}$ $M_{sun}$/yr. Another star (ε Cha 13) showed strong forbidden [OI], [OII] [NII], [SII], [CaII] and [FeII] emission, characteristic of a low-density wind from its transitional disc.

***Right:** Hα velocity profiles of three accreting members. Note the large daily variation in ε Cha 8. ε Cha 11 has an edge-on disc and is under-luminous in the CMD.*

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For more information and references see **http://is.gd/EpsilonCha, astro-ph/1305.4177 (MNRAS, in press)**, or just ask!