eROSITA - StarsWG Report

Jan Robrade

Hamburger Sternwarte

eROSITA meeting, Potsdam, 04-07 March 2019

The eROStars WG

Members of eROStars WG (2019/03)

Hamburger Sternwarte (lead inst.)
Chairs: Jan Robrade, Juergen Schmitt $\longrightarrow$ deputy
Stefan Czesla, Christian Schneider

AIP
Sydney Barnes, Katja Poppenhaeger, Axel Schwope

IAAT
Martina Coffaro, Enza Magaudda, Beate Stelzer

MPE
Vadim Burwitz, Roland Diehl, Michael Freyberg

The eROStars WG

Main Focus: (early) science projects

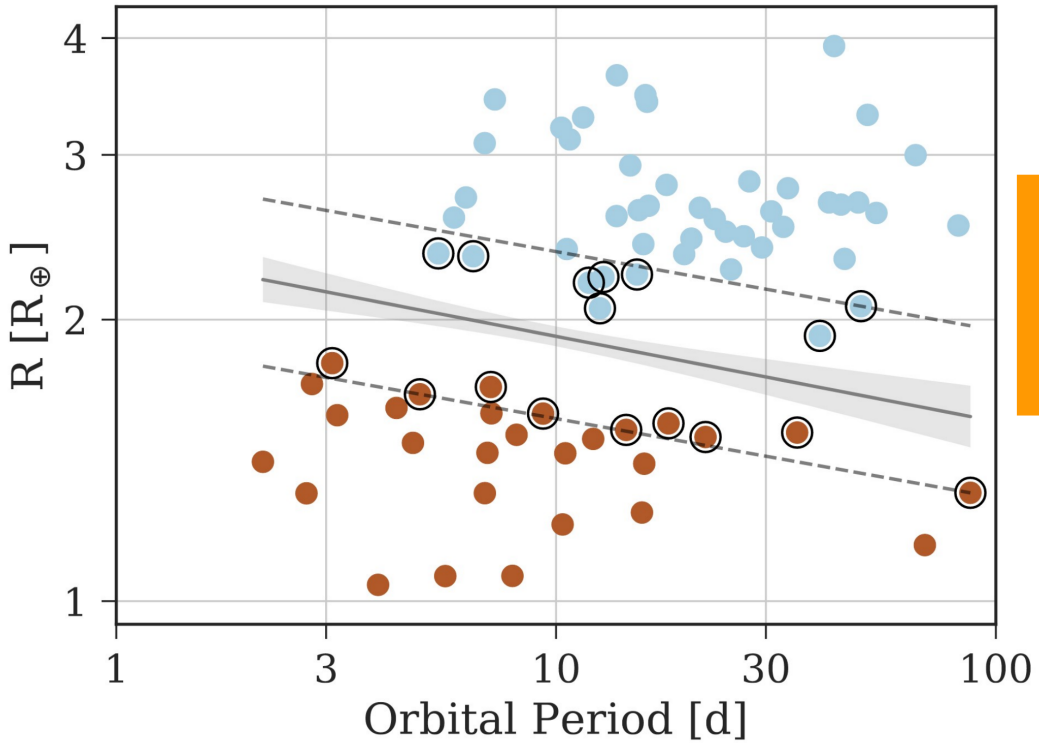
PV Phase

- eta Cha cluster (eROStars PV observation)
  - field scan mode 5 x 5 x 5 [deg x deg x ks]
- stellar content of other PV field scans

eRASS1 + beyond

- 10+ projects defined
- project leads: AIP, HS, IAAT
- many collaborative approaches & synergies
- eROStars@Wiki, more details soon, eROPUB

1) X-rays from exoplanet host stars



XUV flux as evaporation driver

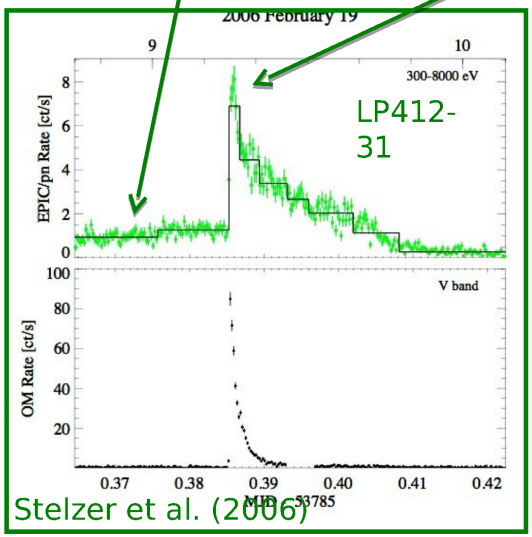
$L_{x,\,min} = 10^{24}\ d^2$ erg/s,
10^{27} out to 30 pc,
10^{28} out to 100 pc

+ Gyrochronology (S. Barnes), joint optical/MWL campaign...

Ultracool Dwarfs (UCDs)

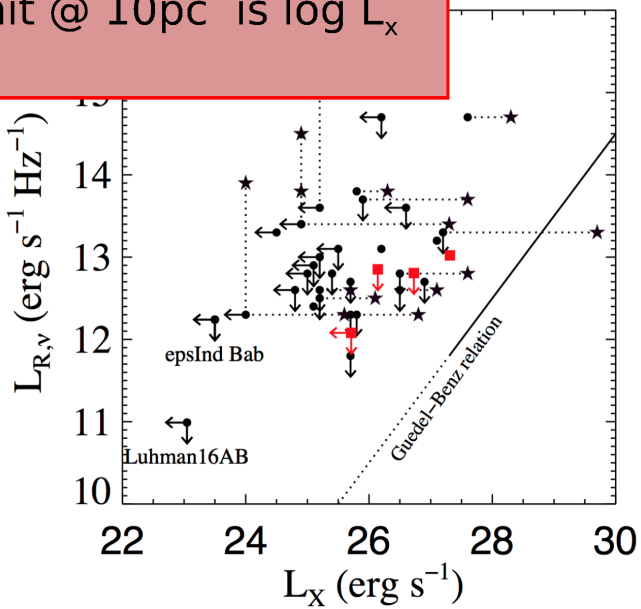
log $L_{x,qui}$ [erg/s] = 27.2

log $L_{x,peak}$ [erg/s] = 29.7



Simultaneous optical/X-ray flare with XMM-Newton on an UCD (Spt46)

eROSITA (X-ray flares):
eRASS limit @ 10pc is log L_x ~ 26.0



Current status:
≈ 10 X-ray detections, some during flares
almost no X-ray spectral information
indications for two populations: “normal” coronae + radio-burste

+ M dwarfs activity vs. K2, TWA study, FUOr/EXOr outbursts...

eROStars - CalPV program

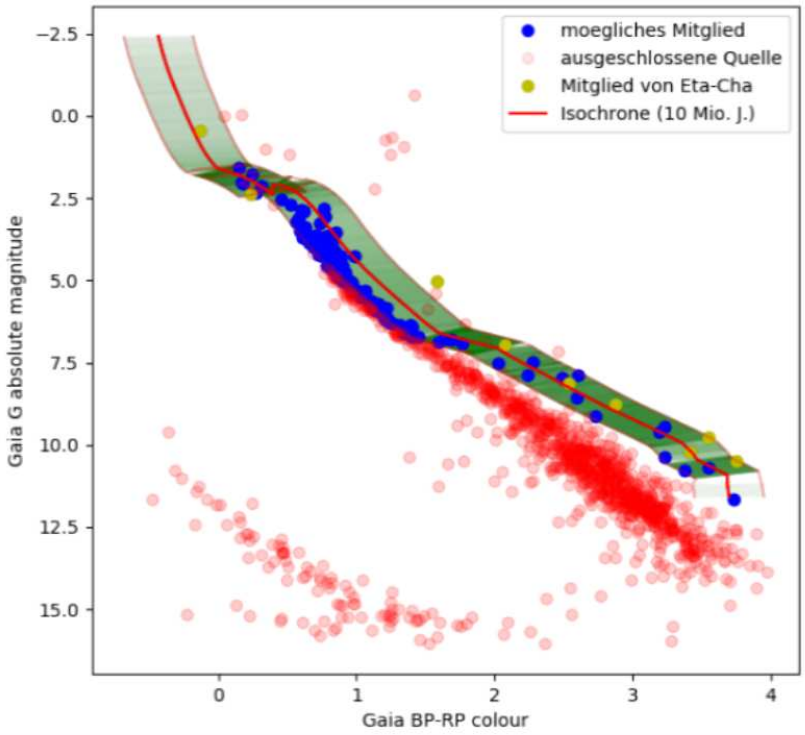
η Cha (B8V) and field (DSS)

The η Cha cluster

- nearby (100 pc) star forming region, intermediate age (5−8 Myr)
- 150 ks field scan mode, 5 x 5 deg
- 5 ks depth: $\log L_{\mathrm{X\,lim}} \approx 6 \times 10^{27}$ erg s^{-1}

First eROSITA project: η Cha Cluster

- Nearby ($\sim$ 100 pc), young cluster
- X-ray discovered by ROSAT (Mamajek et al., 1999)
- 18 known members, but too few low-mass members
- Approved eROSITA PV-program



Walter Bachelor Thesis

HS -project: Finding & characterizing X-ray stars

All-sky surveys for all-sky data

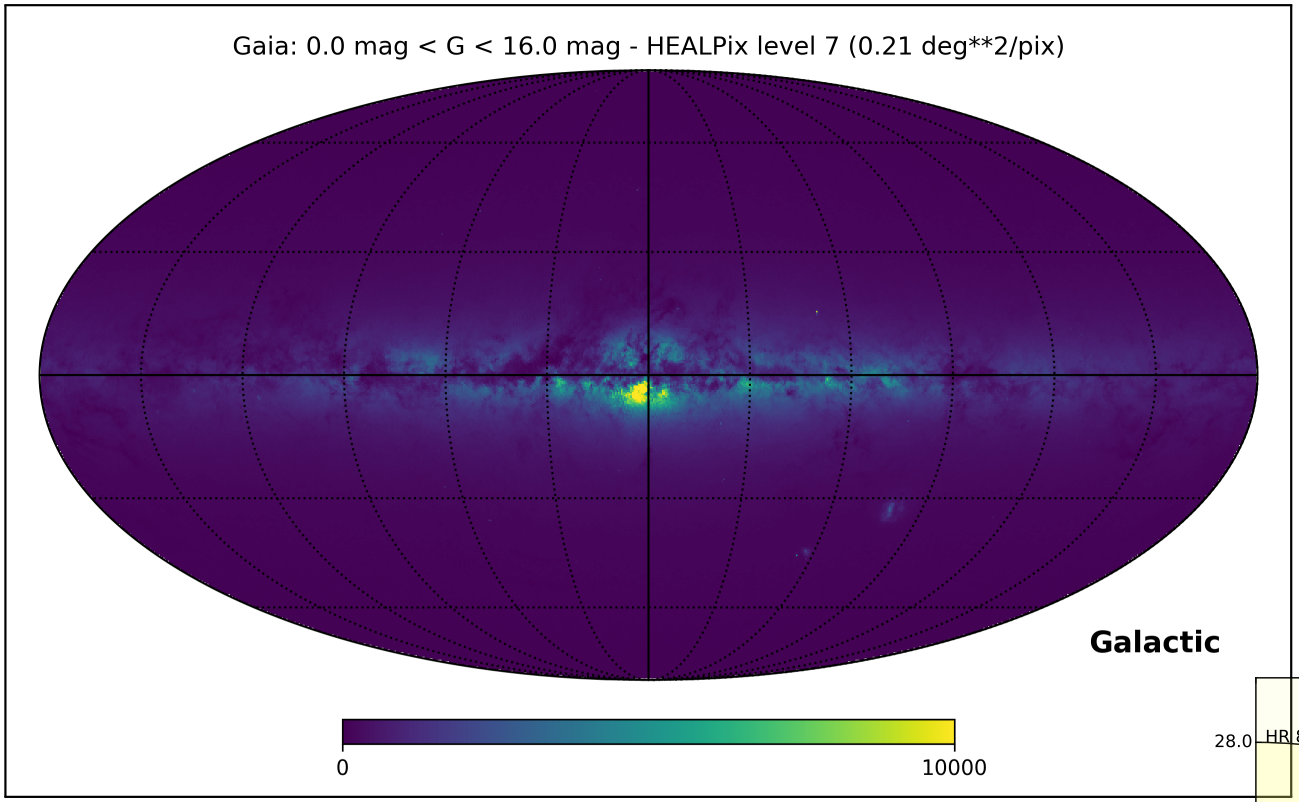
Main identifications:

- Gaia – $\mathbf{1.3 \times 10^9}$ objects, G $\lesssim$ 20 mag (+ BP/RP & RVS spectra)
- 2MASS – $\mathbf{4.5 \times 10^8}$ objects, J/H/K ($\lesssim$ 16/15/14 mag)
- ALLWISE – $\mathbf{7.5 \times 10^8}$ objects, 3.4, 4.6, 12 and 22 μm (W1 $\lesssim$ 16 mag)
- TYCHO-2 – $\mathbf{2.5 \times 10^6}$ objects, B/V (V $\lesssim$ 11 mag)

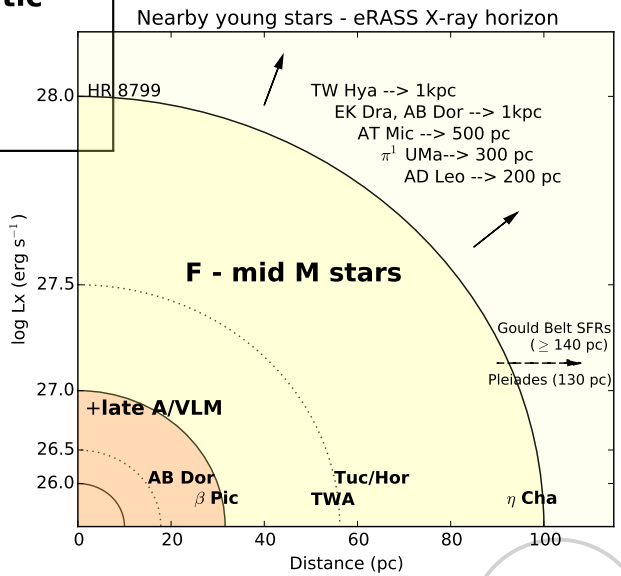
- full eRASS coverage (completeness $\gtrsim$ 99 %)
- Besancon model: $\sim 0.7 \times 10^6$ X-ray stars in eRASS
- detection limit: $L_{\rm X} \approx 1 \times 10^{24} \times d^2({\rm pc})$ [erg/s]

- coronal sources: activity range $\log L_{\rm X}/L_{\rm bol} \approx -3 \ldots -7$
- lim. $F_{\rm X} \Longrightarrow$ lim. $F_{\rm opt}$ per spT/color/$T_{\rm eff}$ and phot. band

Stellar cross-matching



$\sim 10^8$ DR1 sources
moderate
counterpart
surface density
($\lesssim 1$ @ r $= 10''$)



Gaia + 2MASS etc.

- accurate parallaxes for eRASS stars ($F \rightarrow L$)
- opt. fainter sources are nearby

ID-space: position, distance, colors

Stars in eRASS1+

Stellar science with eRASS1

sample size $\sim$ 50000 stars

- comparison to RASS / X-ray catalogs, new sources
  - ongoing X-ID project @HS (XMMSL, 3XMM, 2RXS...)
  - variability (baseline of up to 25 years)
- new MWL/auxiliary activity data (rotation periods, CaII H+K,...)
  - stellar population studies
  - activity-age-rotation relation
  - ongoing/upcoming: Gaia DR3/4, TESS,...
- dedicated MWL and follow up campaigns

eROStars & collaborations

Inter-National: several high-expertise groups expressed interest in eROSITA

Russian side: working group established (SAI lead); collaborations very welcome