

Исследование звёздных скоплений в эпоху больших обзоров

Investigation of star clusters during the era of large surveys

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Цель: извлечь максимум информации из имеющихся больших каталогов

GAIA

2MASS

WISE

IPHAS (фильтры R, I, H_alpha)

VPHAS

URAT1

UCAC5

USNO-B1.0 (фильтры B1, B2, R1, R2, I)

до 13 положений на объект на интервале ~50 лет

Программа Crossmatch: удобство, скорость, гибкость

Одной строкой можно провести множественную кроссидентификацию звёзд с использованием 8 каталогов (данные берутся из VizieR), сразу накладывая все необходимые ограничения.

Пример:

```
java -jar Crossmatch.jar ra=298.052 dec=29.408  
area_radius=0.1667 crossmatch_radius=2  
filter=IPHAS: "r < 17 || i < 17" filter=GAIA:  
"ucd$phot_mag_stat_mean_em_opt < 19"
```

Программа Crossmatch: гибкость

Добавление столбцов:

```
java -jar Crossmatch.jar ra=298.052 dec=29.408  
area_radius=0.1667 crossmatch_radius=2  
addcol=2MASS: "dup use"
```

Добавление каталогов:

```
java -jar Crossmatch.jar ra=298.052 dec=29.408  
area_radius=0.1667 crossmatch_radius=2  
addcat=NOMAD: "I/297" addcol=NOMAD: "RAJ2000  
DEJ2000 e_RAJ2000 e_DEJ2000"
```

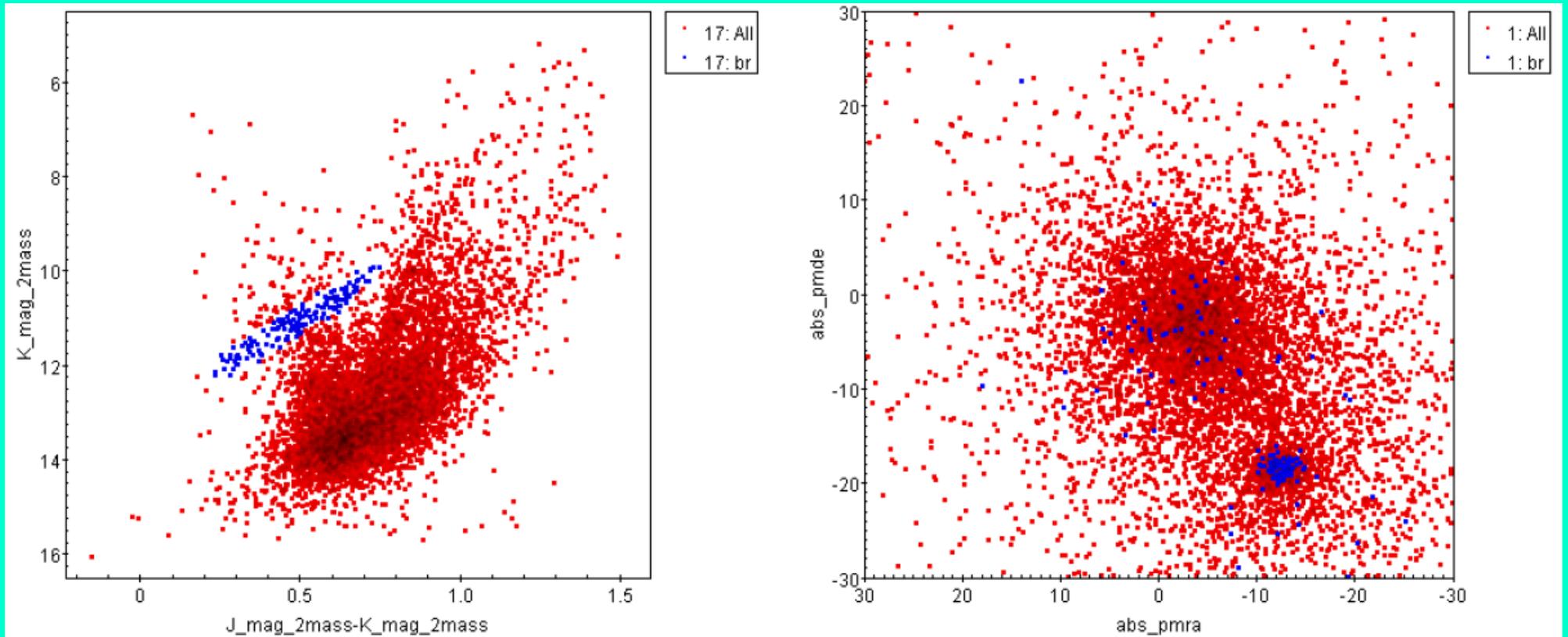
Программа РМ

Написана на языке Python

Вычисляет относительные собственные движения звёзд

Вычисляет абсолютные собственные движения звёзд

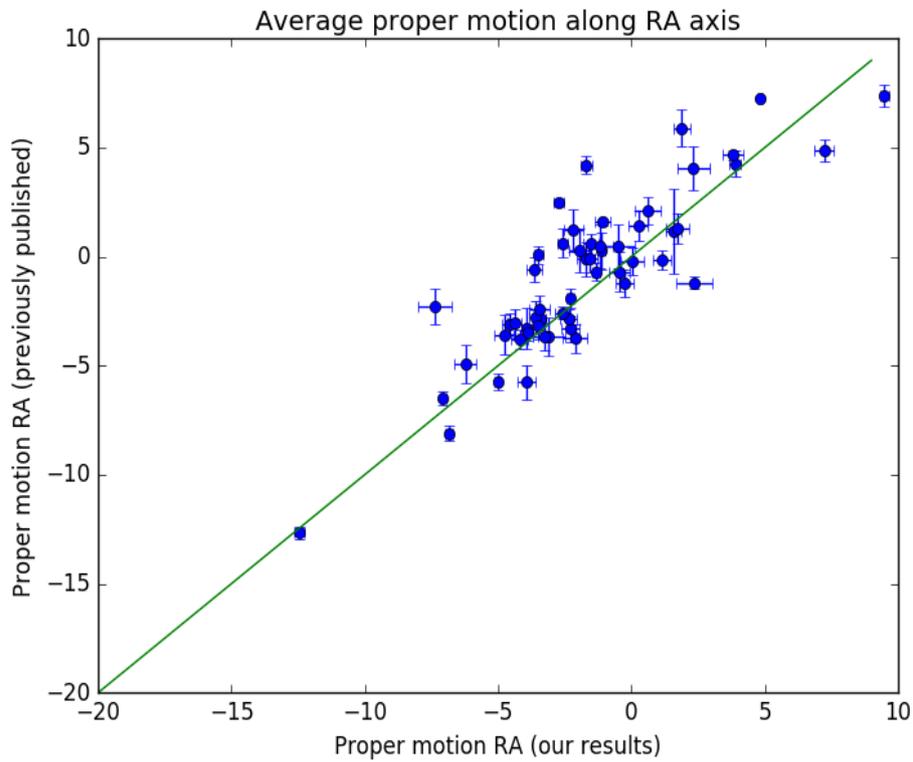
Программа РМ



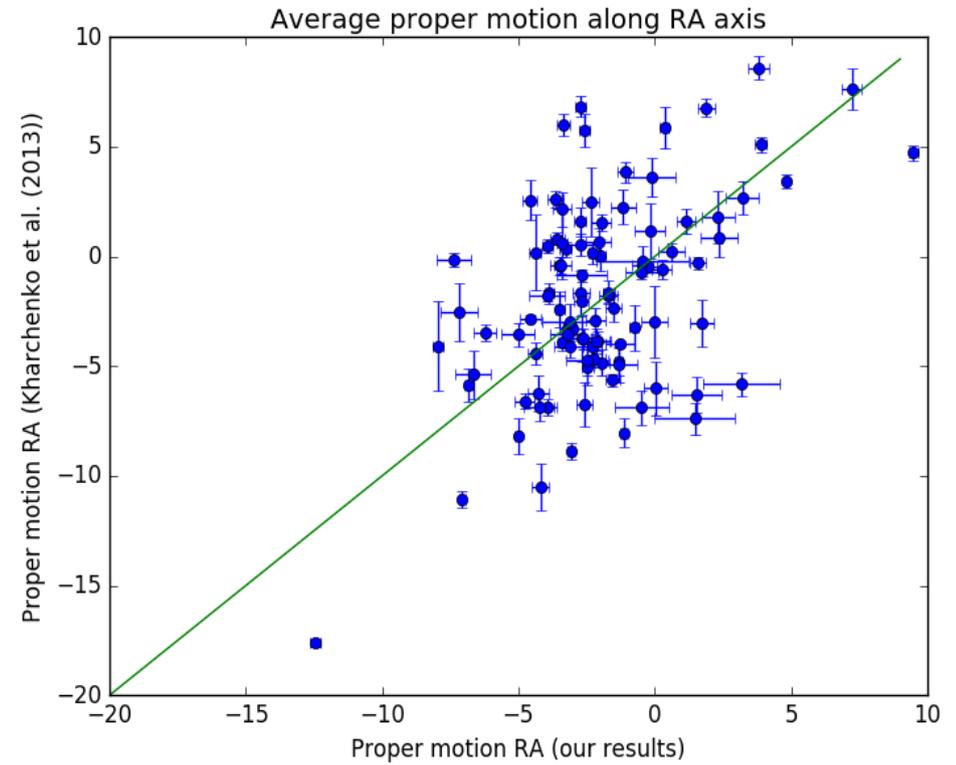
Шаровое скопление M4

Всего исследовано 104 ШЗС

Сравнение результатов:

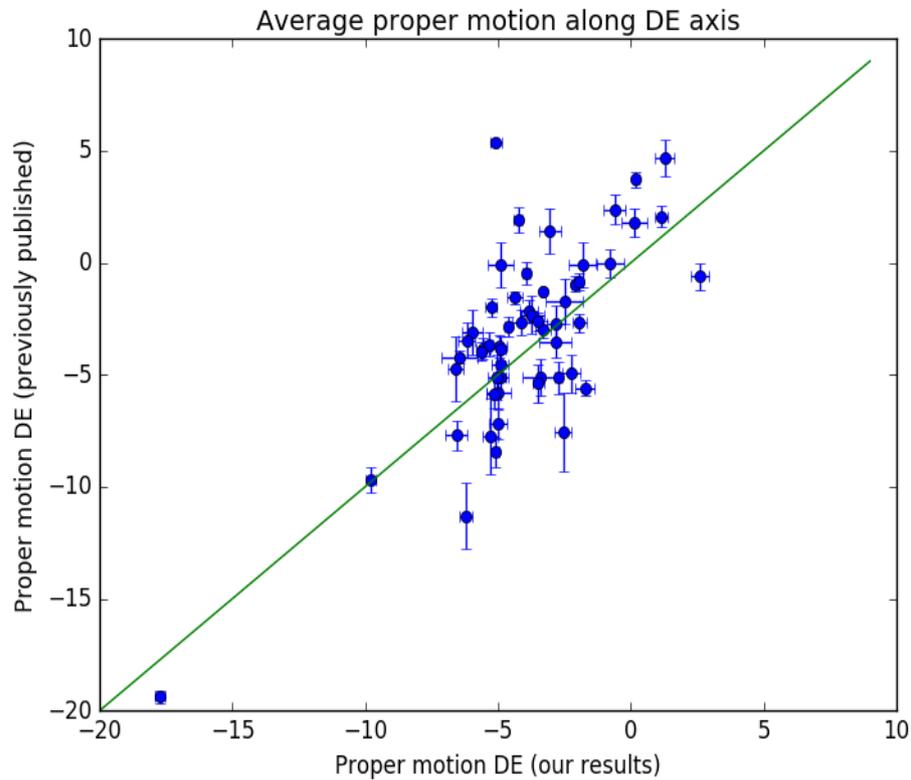


Southern Proper Motion Program (1997-2016)

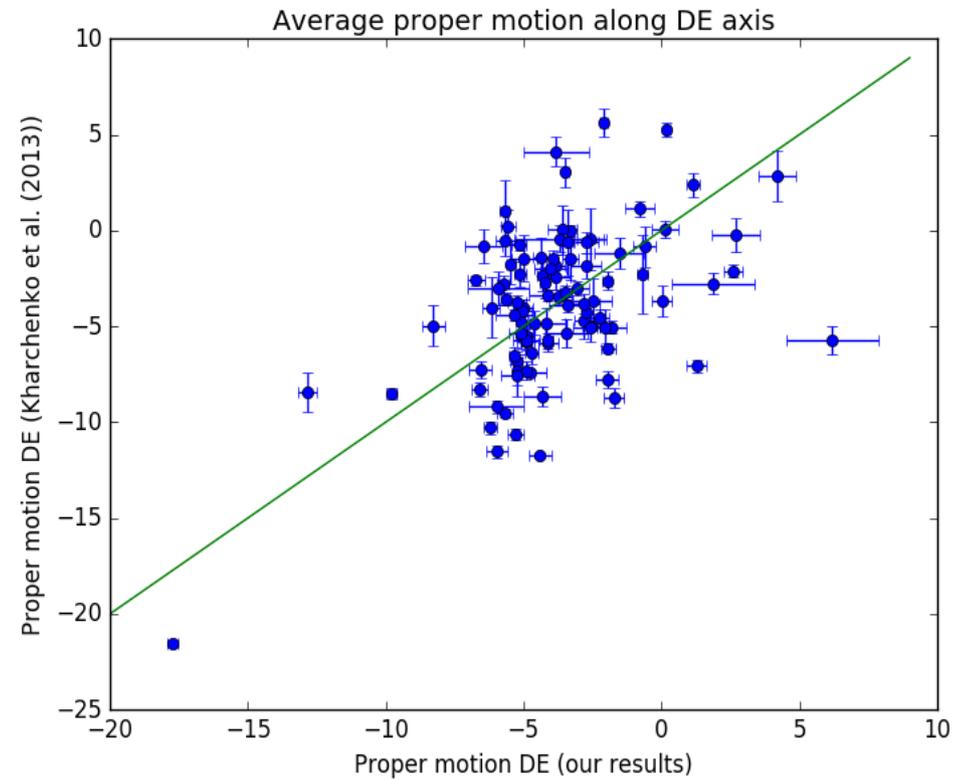


Харченко и др. (2013)

Сравнение результатов:

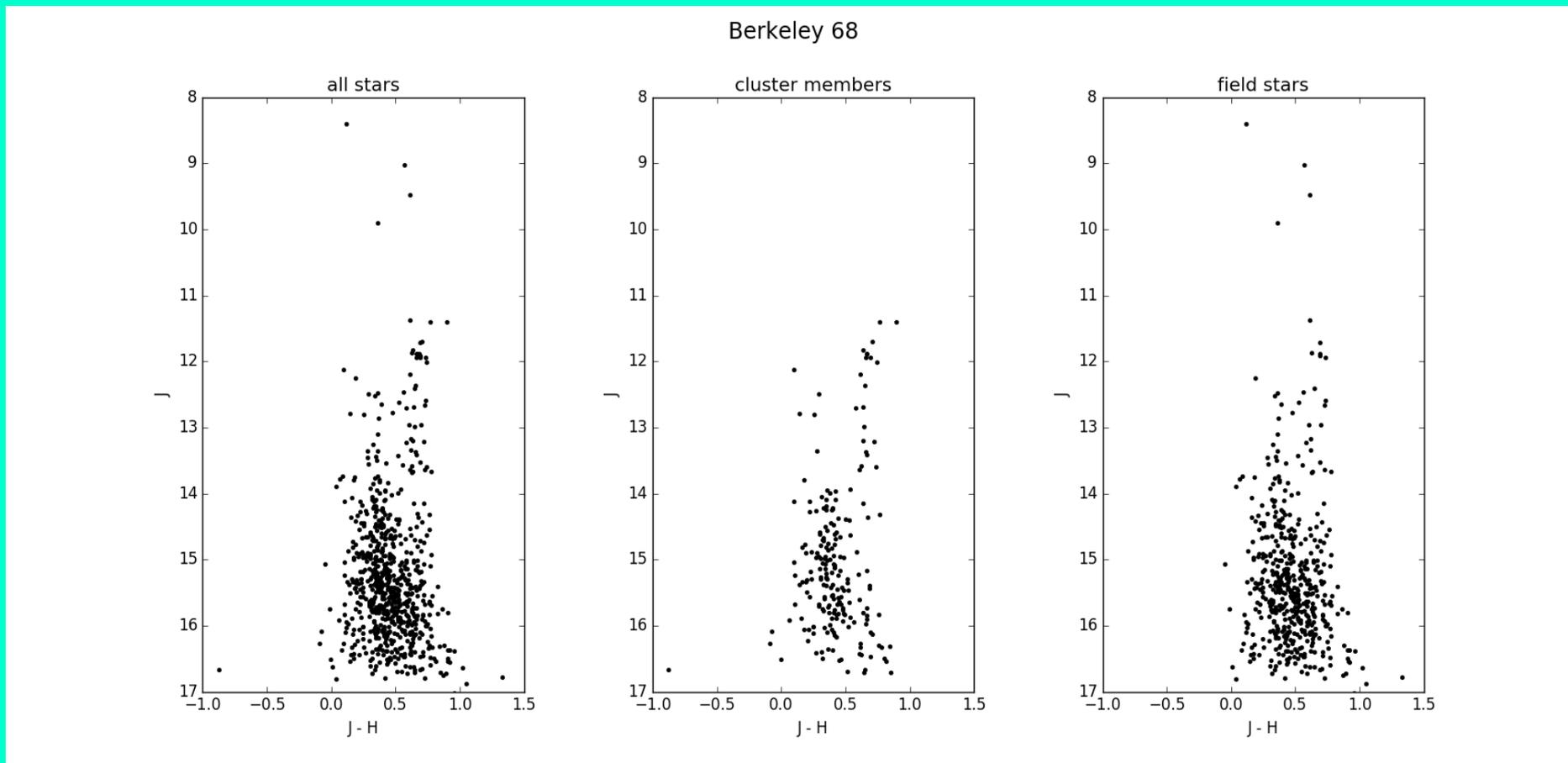


Southern Proper Motion Program (1997-2016)



Харченко и др. (2013)

Выделение членов РЗС методом Сандерса

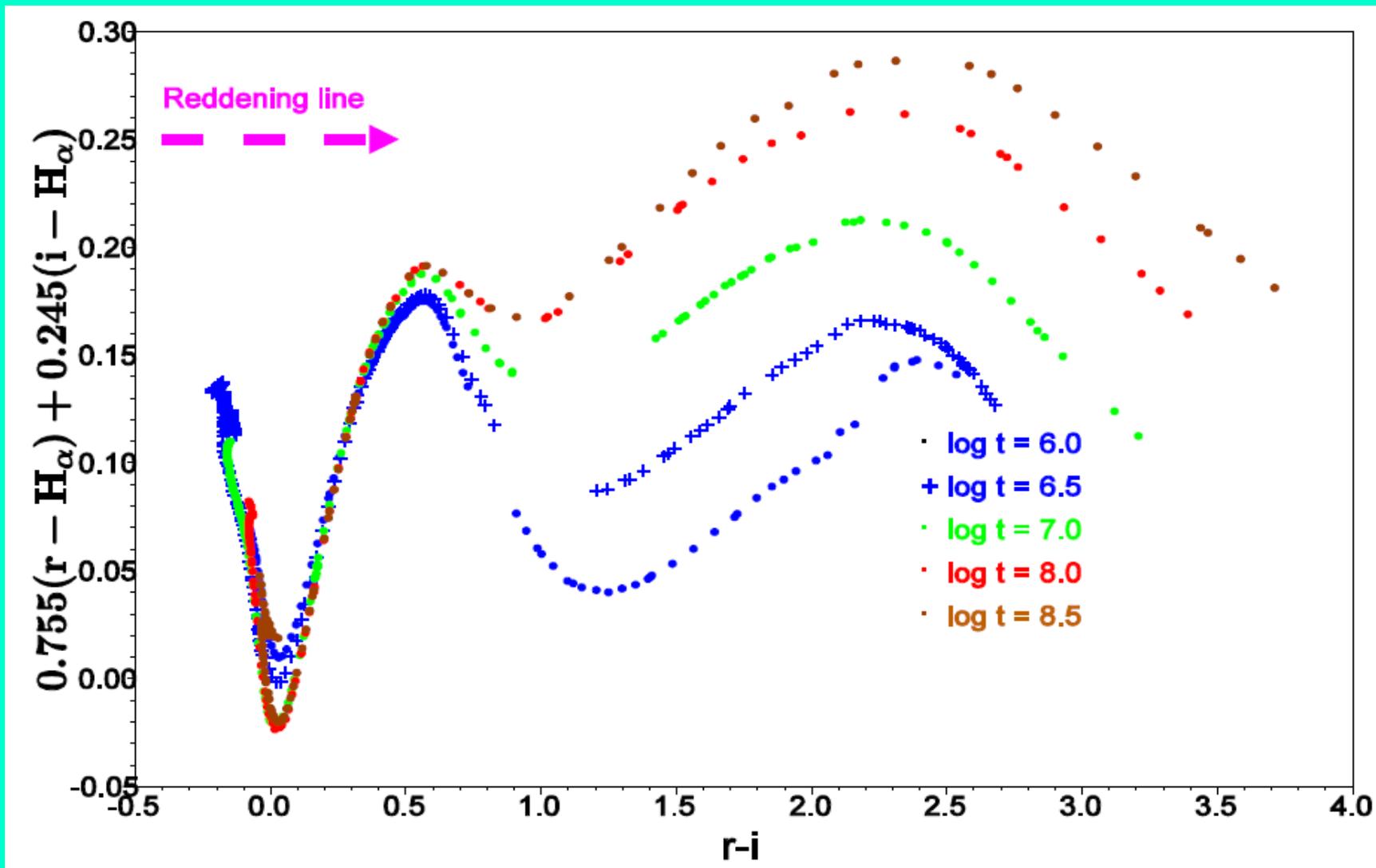


IPHAS DR2 Source Catalogue

<http://www.iphas.org/dr2/>

- [Isaac Newton Telescope](#) (\varnothing 2.5m)
- La Palma, Canary Islands
- [Wide Field Camera](#) (0.3 deg²)
- Four 2048 x 4100 pixel CCD's
- 0.33 arcsec / pixel
- Filters: r, i, H α (Vega system)
- Exposures: 30s (r), 10s (i), 120s (H α)
- Saturation: 13 (r), 12 (i), 12.5 (H α)
- Depth: 21 (r), 20 (i), 20 (H α)
- Median seeing: 1.1 arcsec
- Survey area: 1860 deg²
- Footprint: $|b| < 5^\circ$, $l = 29-215^\circ$
- Observing period: 2003 - 2012
- Reference: [Barentsen et al. 2014](#)
- The INT/WFC Photometric H-Alpha Survey of the Northern Galactic Plane (IPHAS) is
- 219 million stars

Изохроны Bressan et al.(2012) на диаграмме $(H_{\alpha} index, r-i)$



Определение параметров РЗС

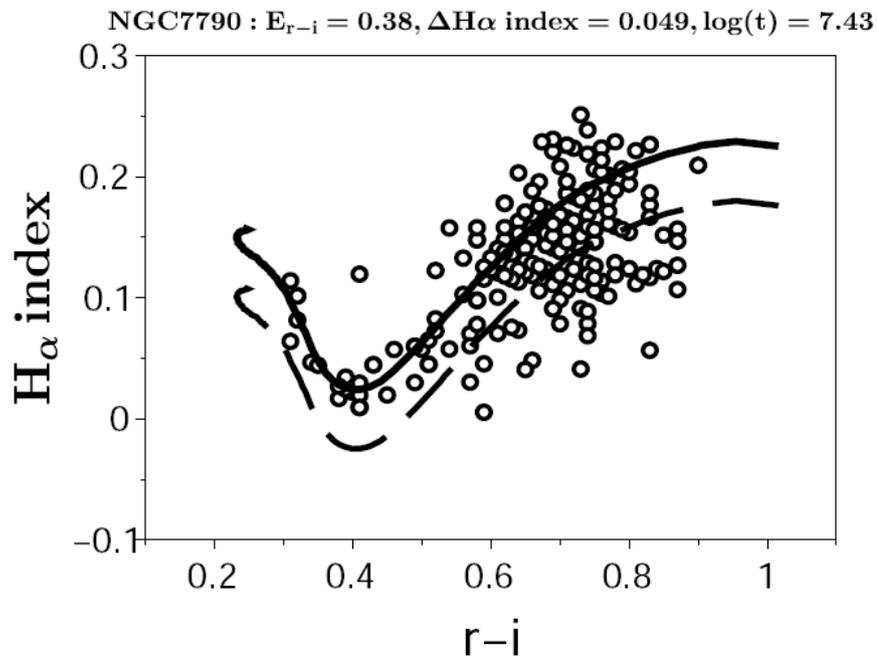


Figure 2. Colour-colour diagram for stars within 3 arcmin of the NGC 7790 cluster centre and the superimposed $\log(t)=7.2$ isochrone shifted by 0.38 mag along the horizontal axis (the thin dashed curve) and the same isochrone shifted by 0.38 mag along the horizontal axis and by $\Delta H\alpha$ index = +0.049 along the vertical axis (the thick solid curve).

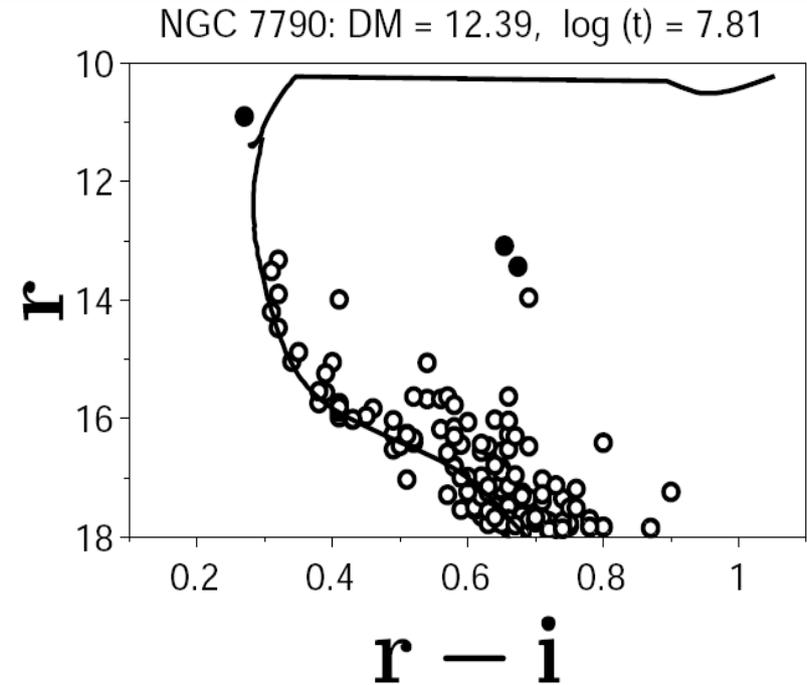
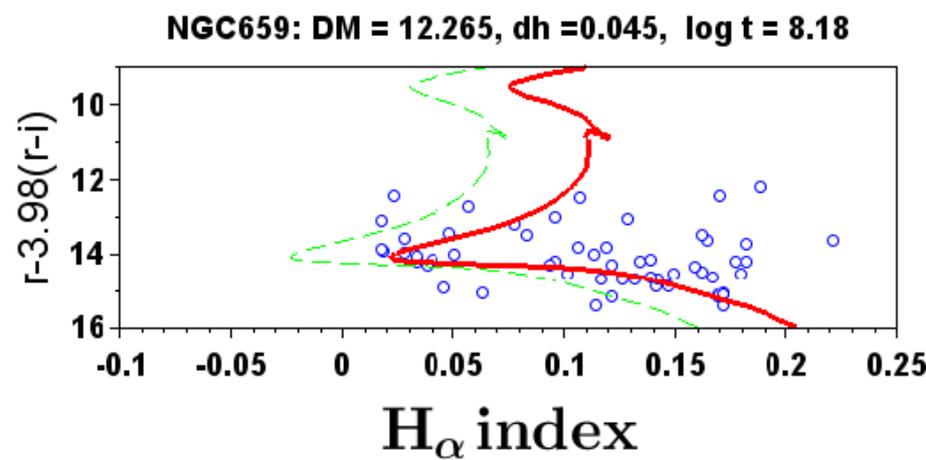
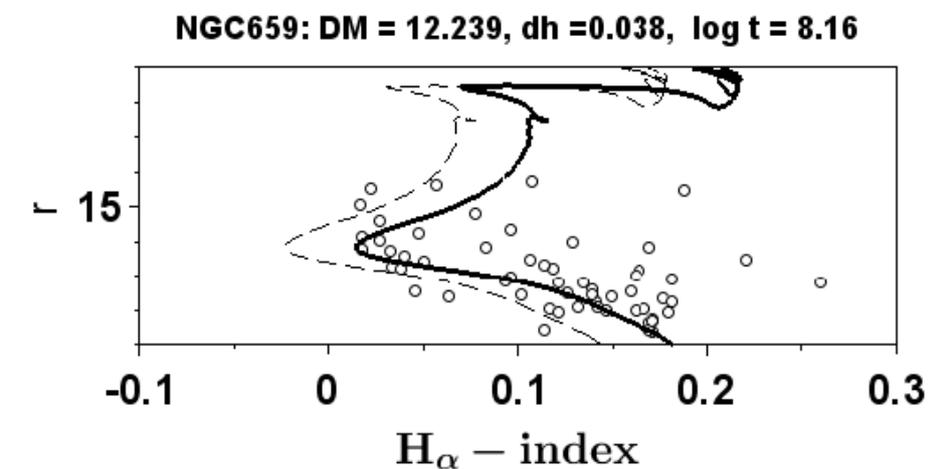
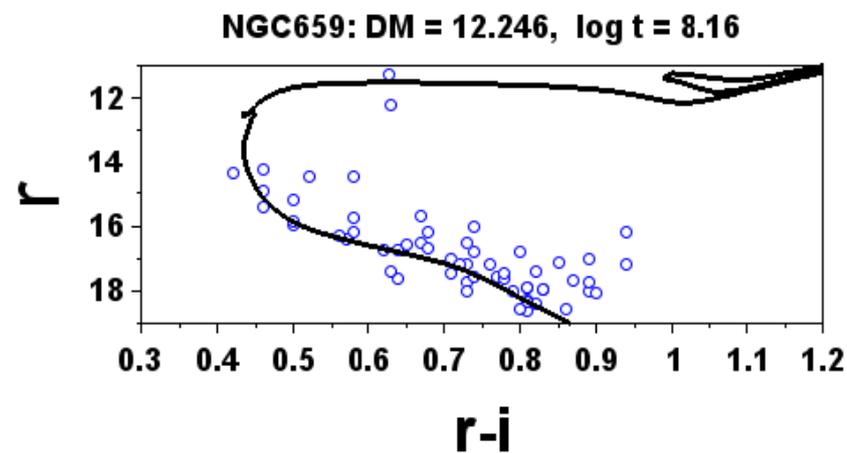
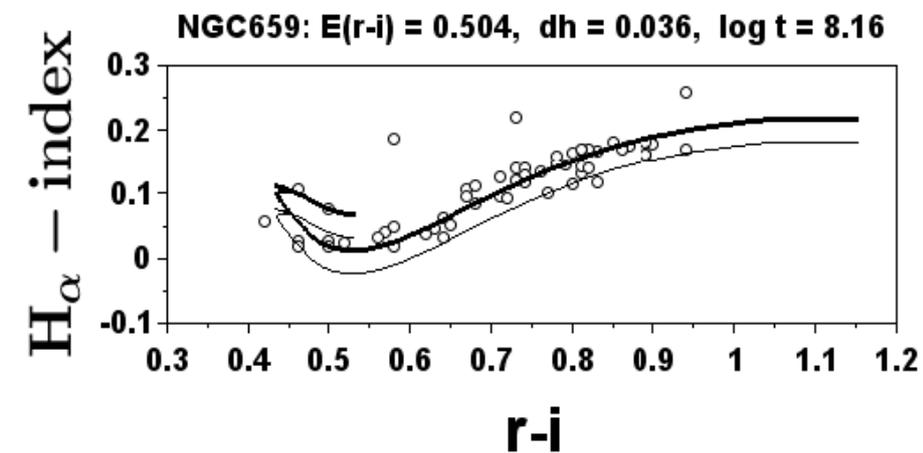
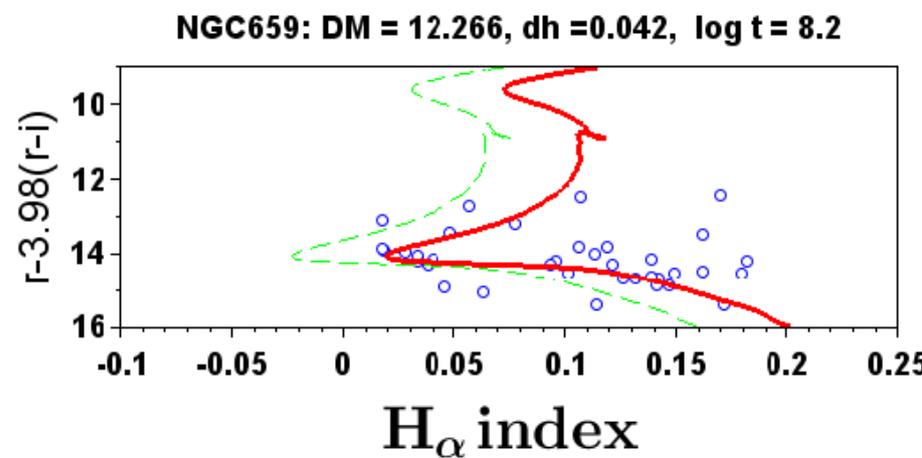
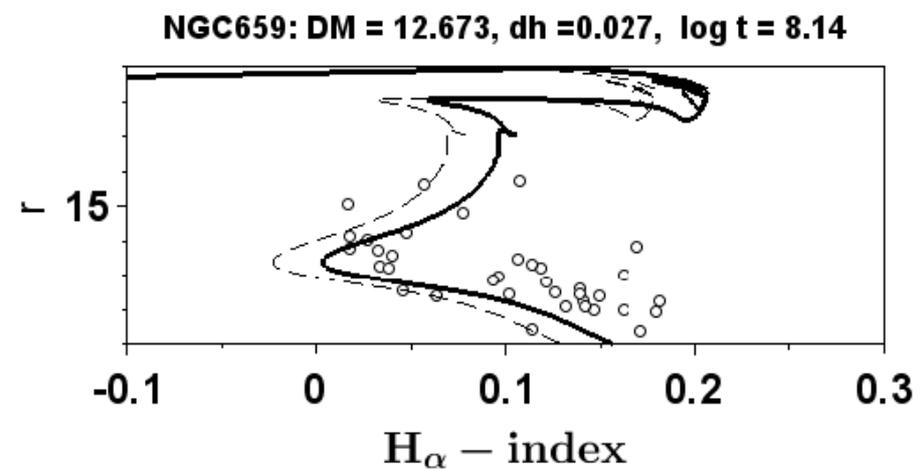
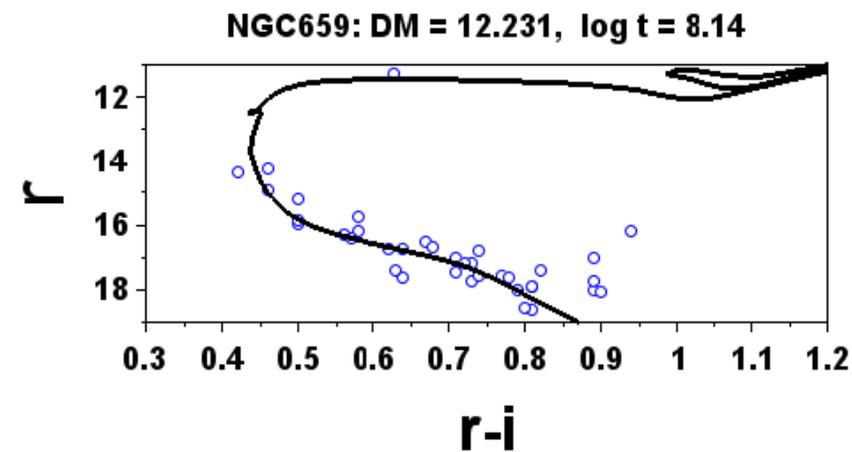
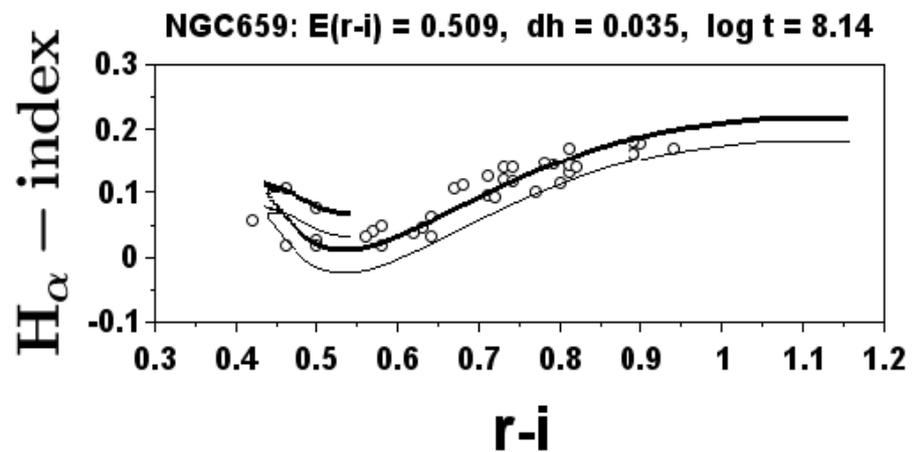


Figure 3. The $(r - i, r)$ colour-magnitude diagram for stars within 3 arcmin from the centre of the NGC 7790 cluster with the superimposed $\log(t)=7.81$ isochrone shifted by 0.38 along the horizontal axis and by 13.90 mag along the vertical axis (the solid curve). The open circles represent unsaturated stars with IPHAS data and the filled circles, stars with APASS ri photometry converted to the IPHAS system in accordance with Eqs. 1 and 2. Given the above colour excess estimate $E_{r-i}=0.38$ mag the true distance modulus is $(m - M)_0 = 12.39$, which corresponds to the distance of $d=3006$ pc.

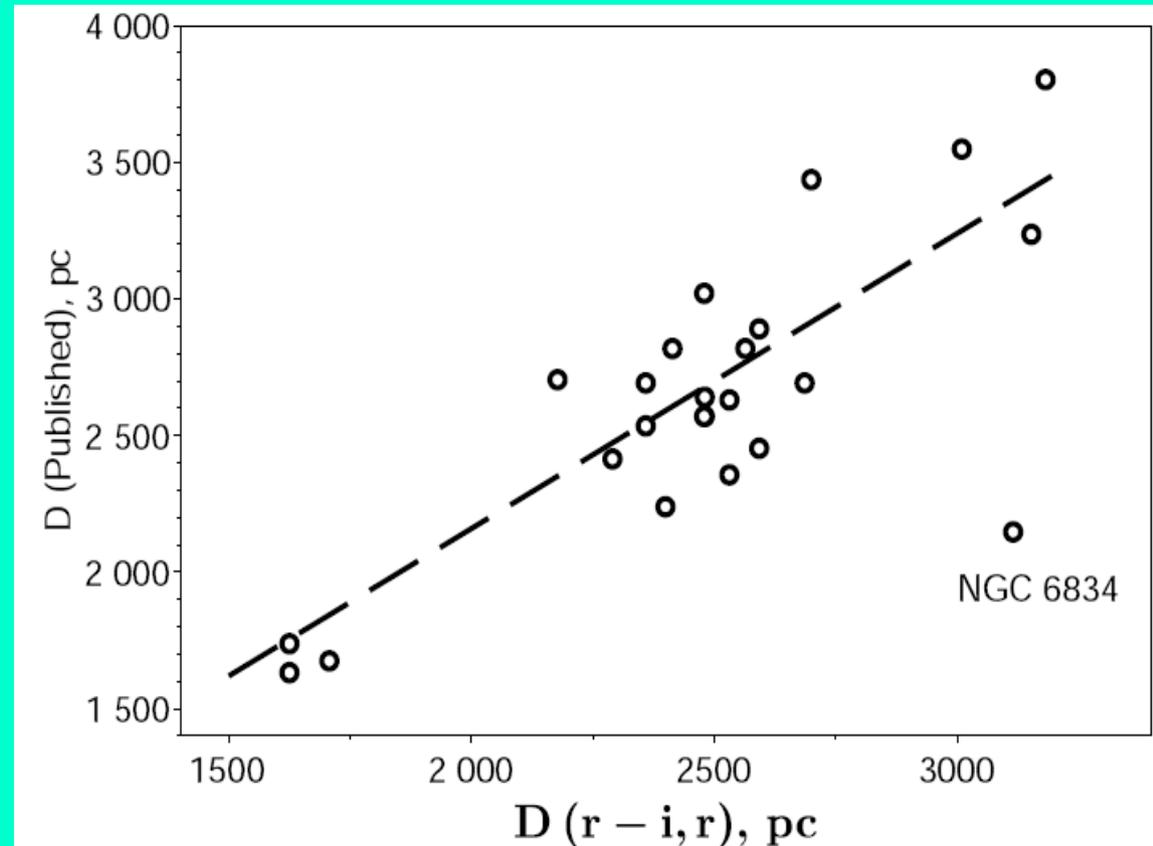
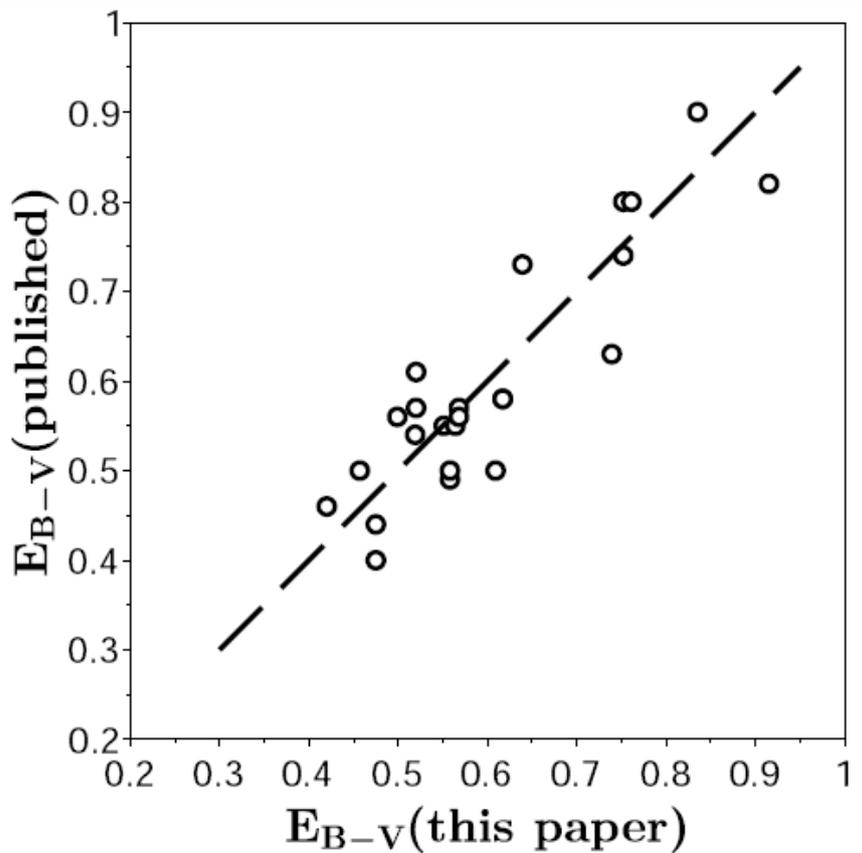
Результаты для всех звёзд в поле NGC 659



Результаты для выделенных членов скопления NGC 659



Сравнение со «стандартными» скоплениями



$$\langle D(Published)/D(r-i, r) \rangle = 1.080 \pm 0.020$$

Dambis et al. 2017

IPHAS: 18 (стандартных) + 129

СПАСИБО ЗА ВНИМАНИЕ!

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