Fewer Companions in the Crowd

The Low Close-Binary Fraction in Globular Clusters from *Gaia* RVS

Dolev Bashi

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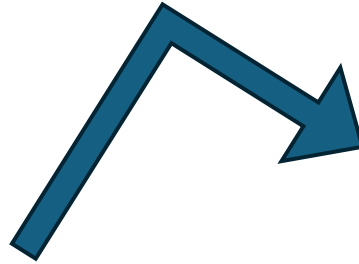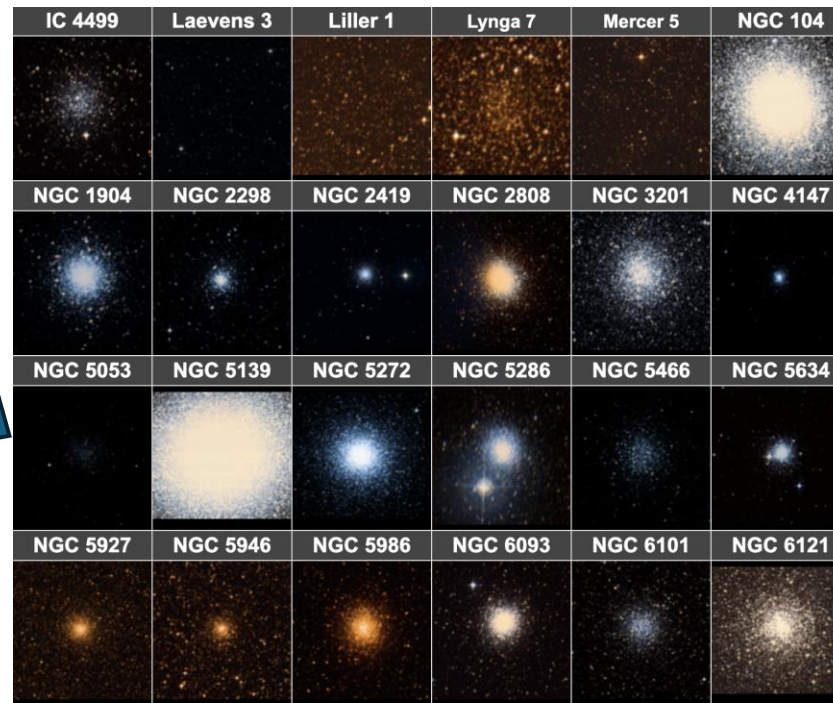In collaboration with Vasily Belokurov

https://arxiv.org/abs/2507.00131

Motivation

Binary stars

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Binary stars

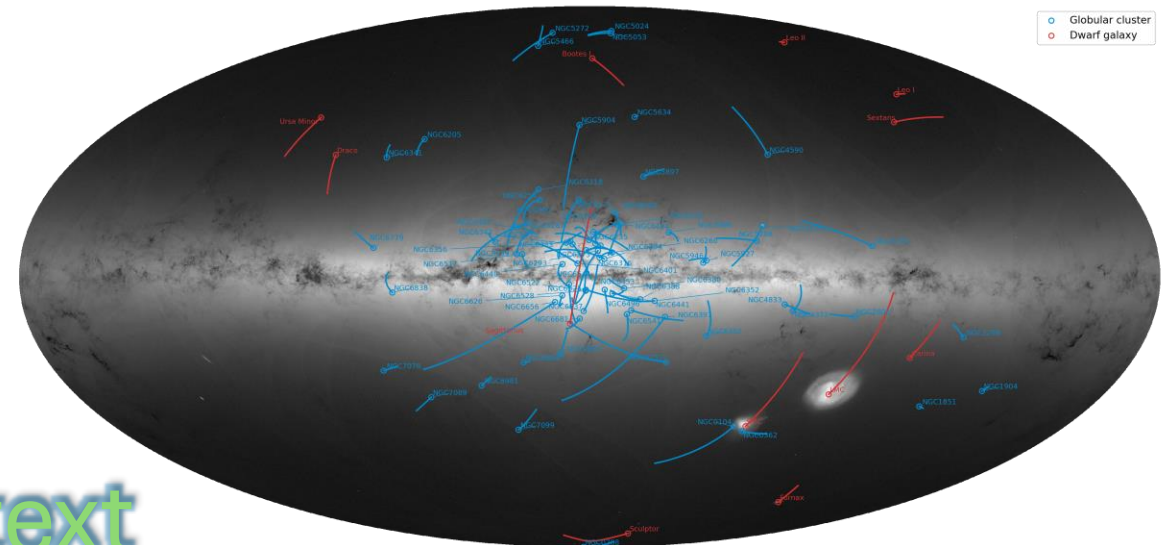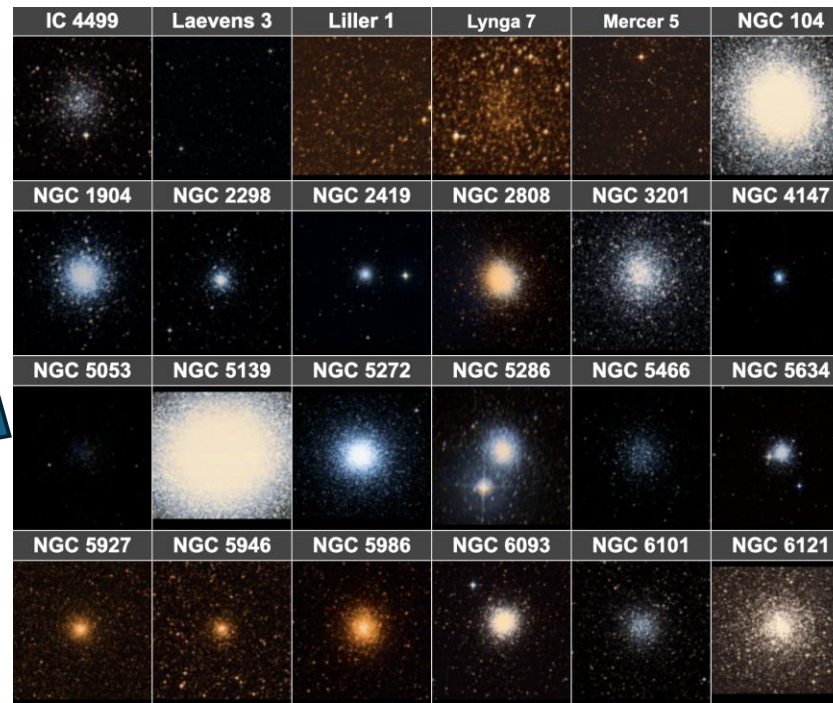## GC dynamics

Motivation

GC dynamics

Binary stars

Galactic Context

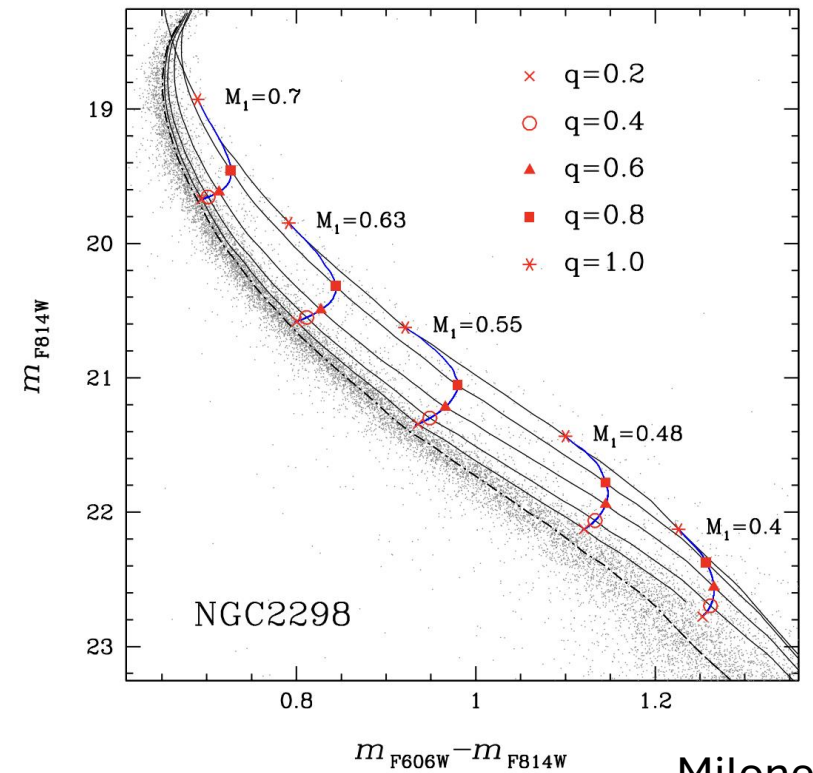# Binaries in GCs: What do we know?

- **Spectroscopy**

- **Photometry**
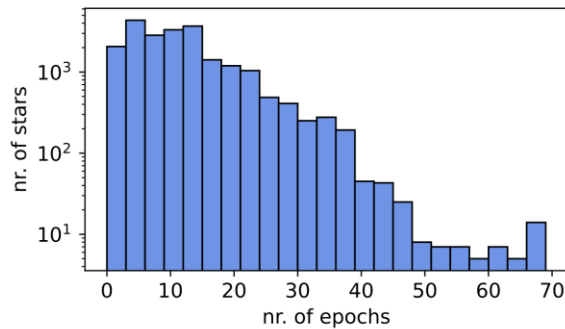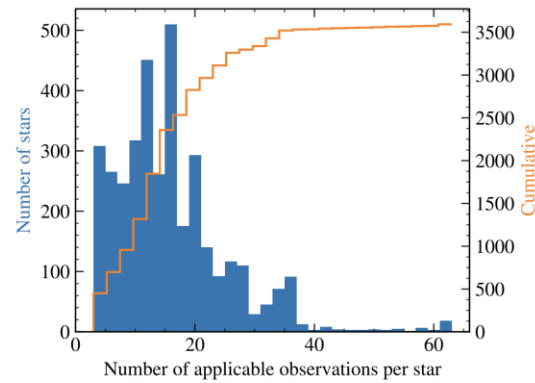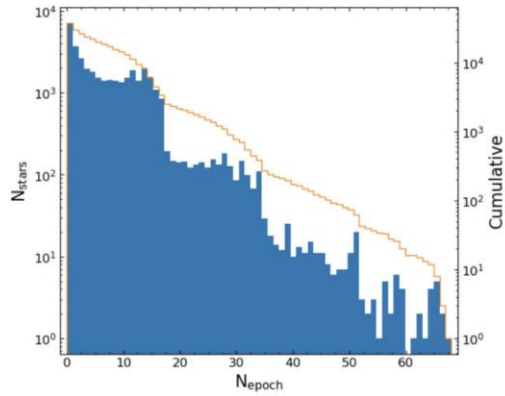
Binaries in GCs: What do we know?
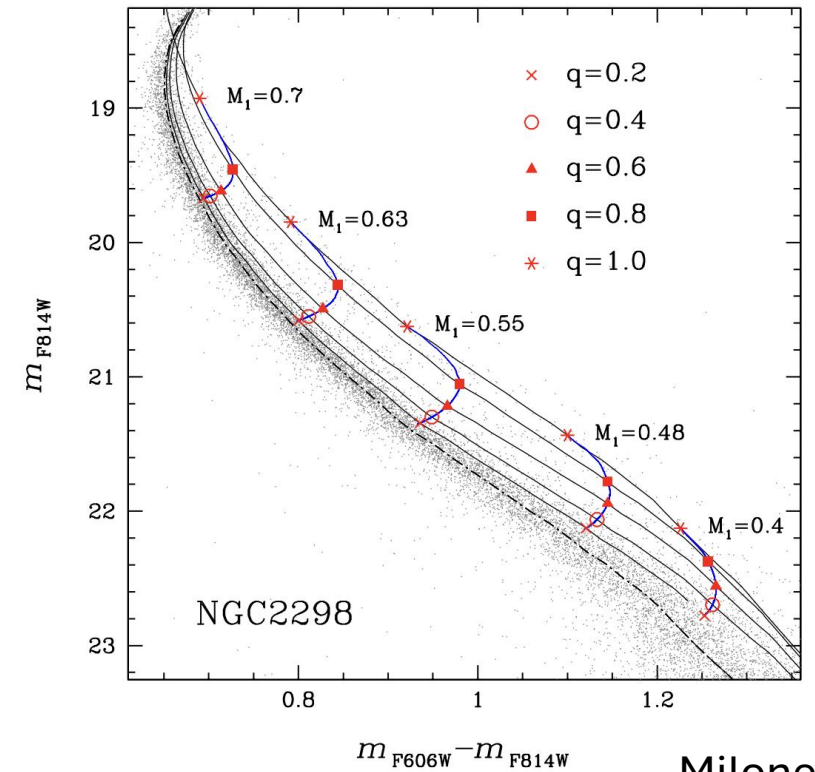
- **Spectroscopy**

- **Photometry**

Milone+12
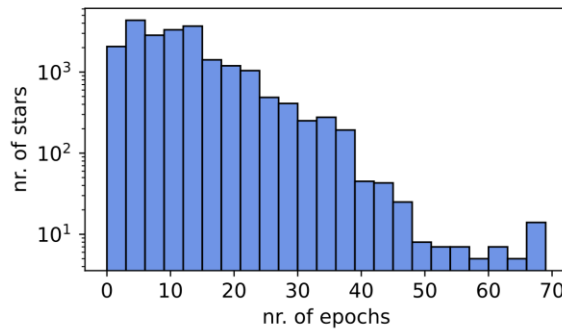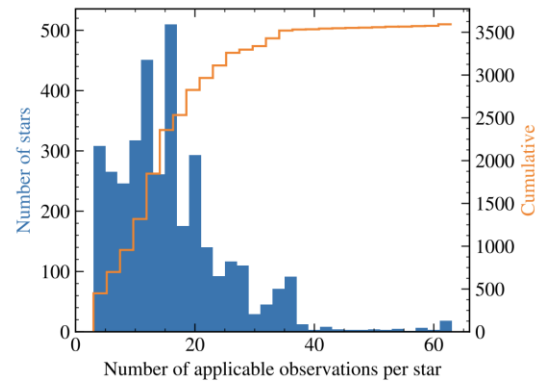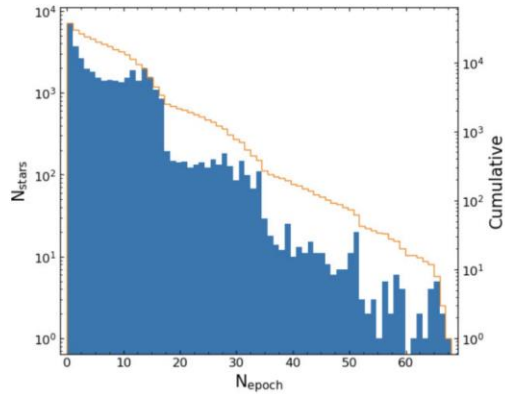
Binaries in GCs: What do we know?

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Wragg+24
(ω Cen)

Giesers+19
(NGC 3201)

Müller-Horn+2025
(47 Tuc)

Milone+12

Binaries in GCs: What do we know?
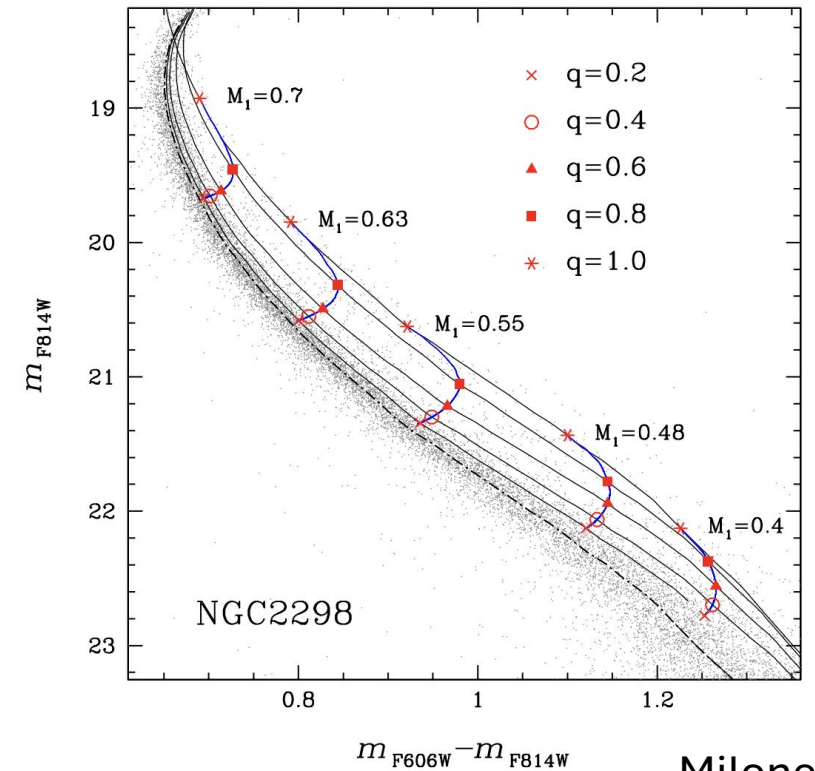
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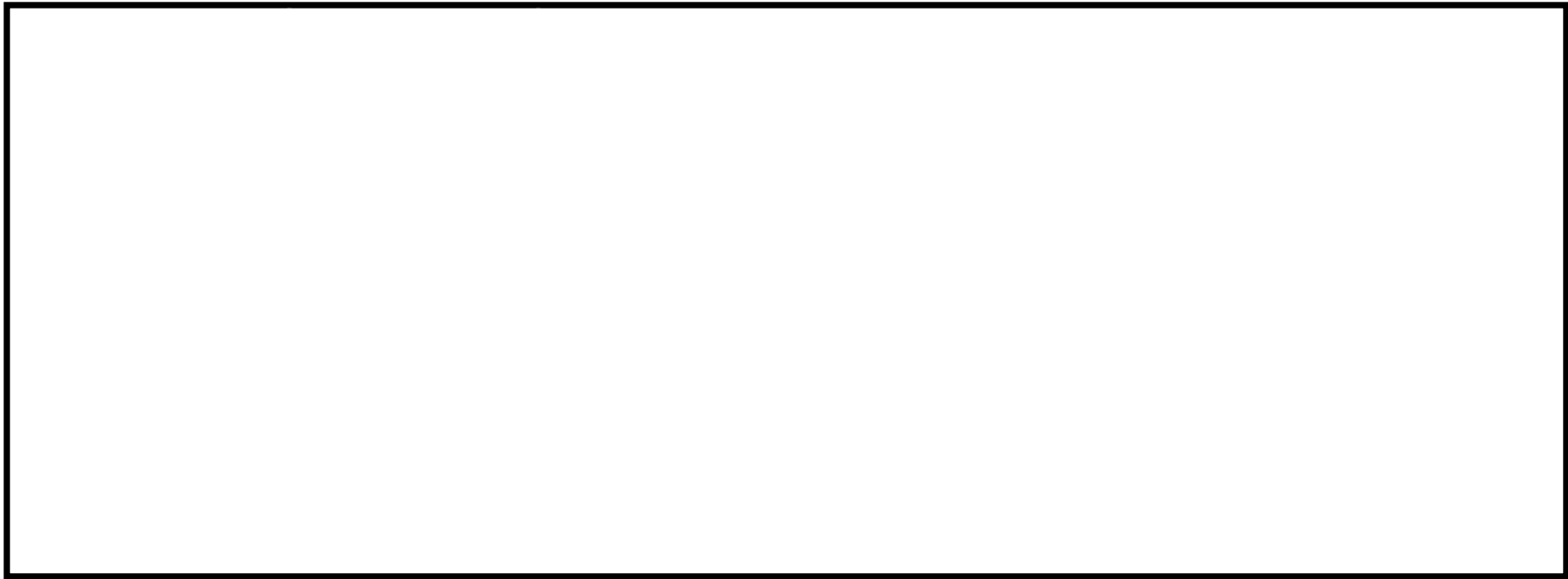(NGC 3201)

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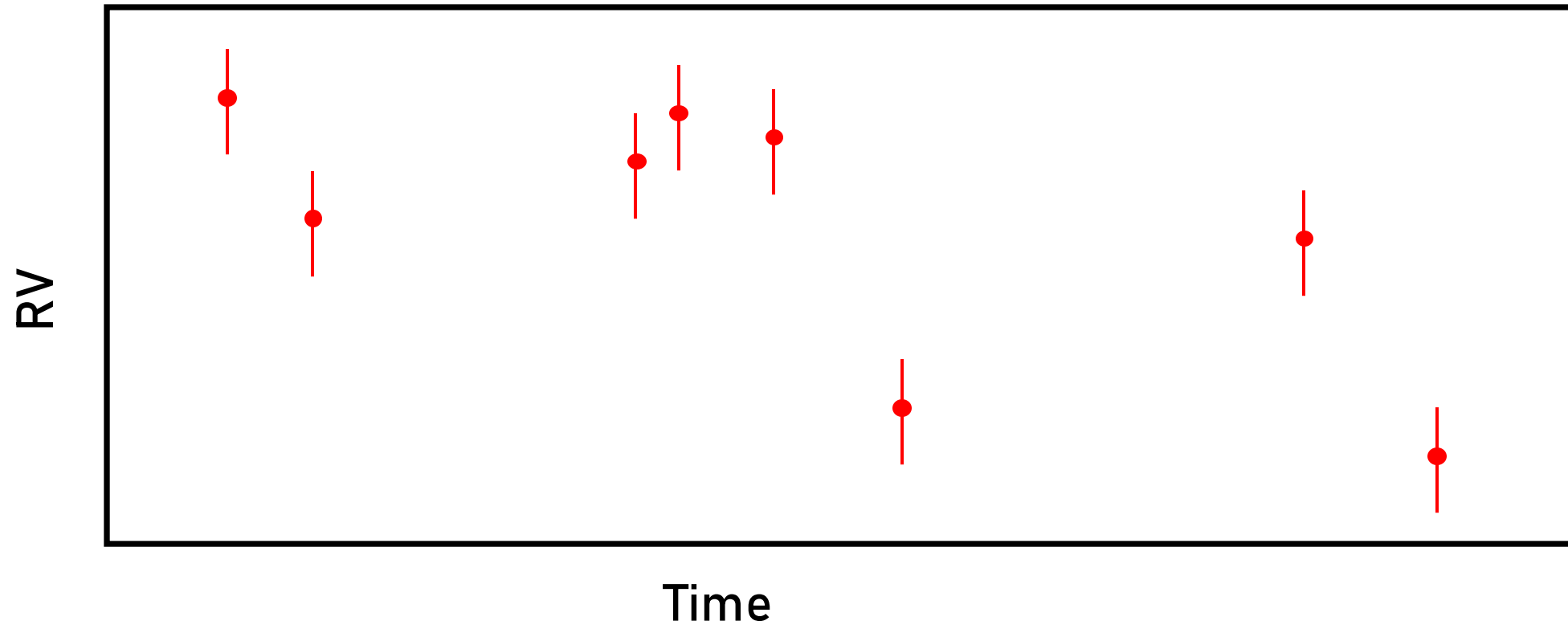
NGC2298

Binaries in GCs are rare!

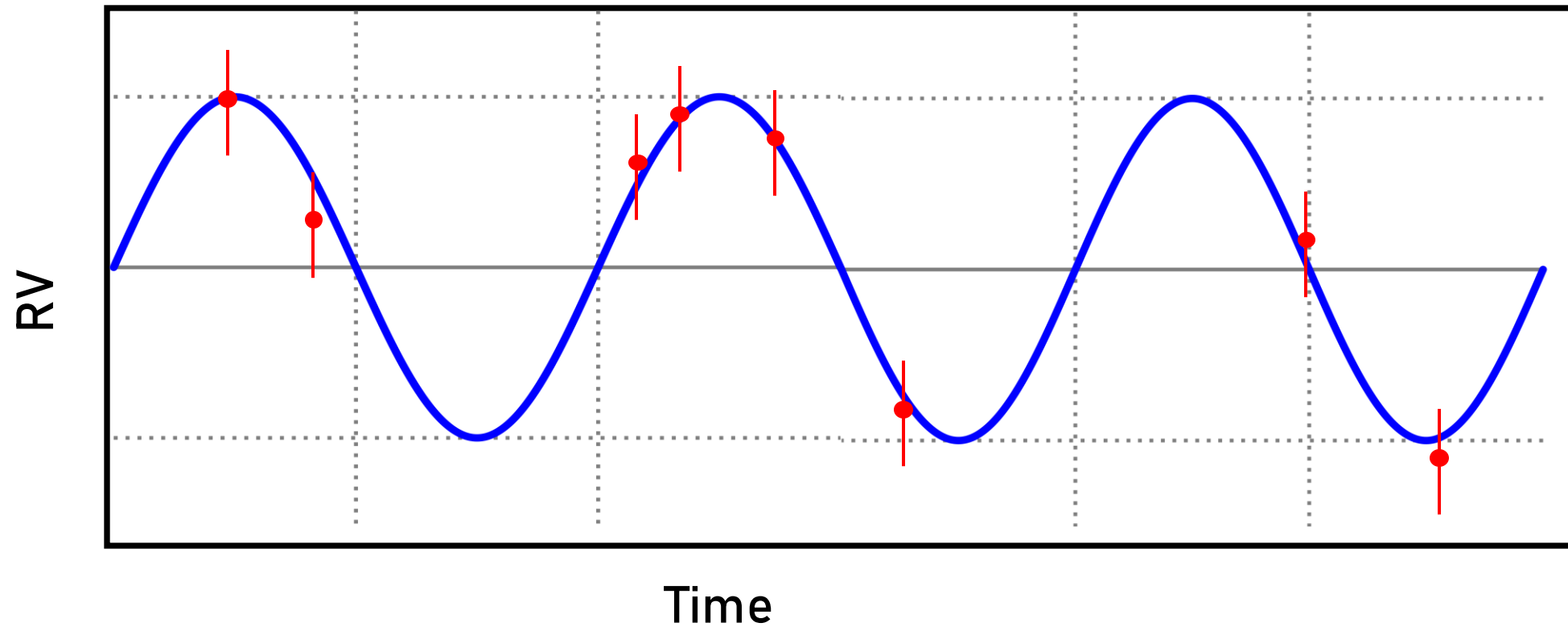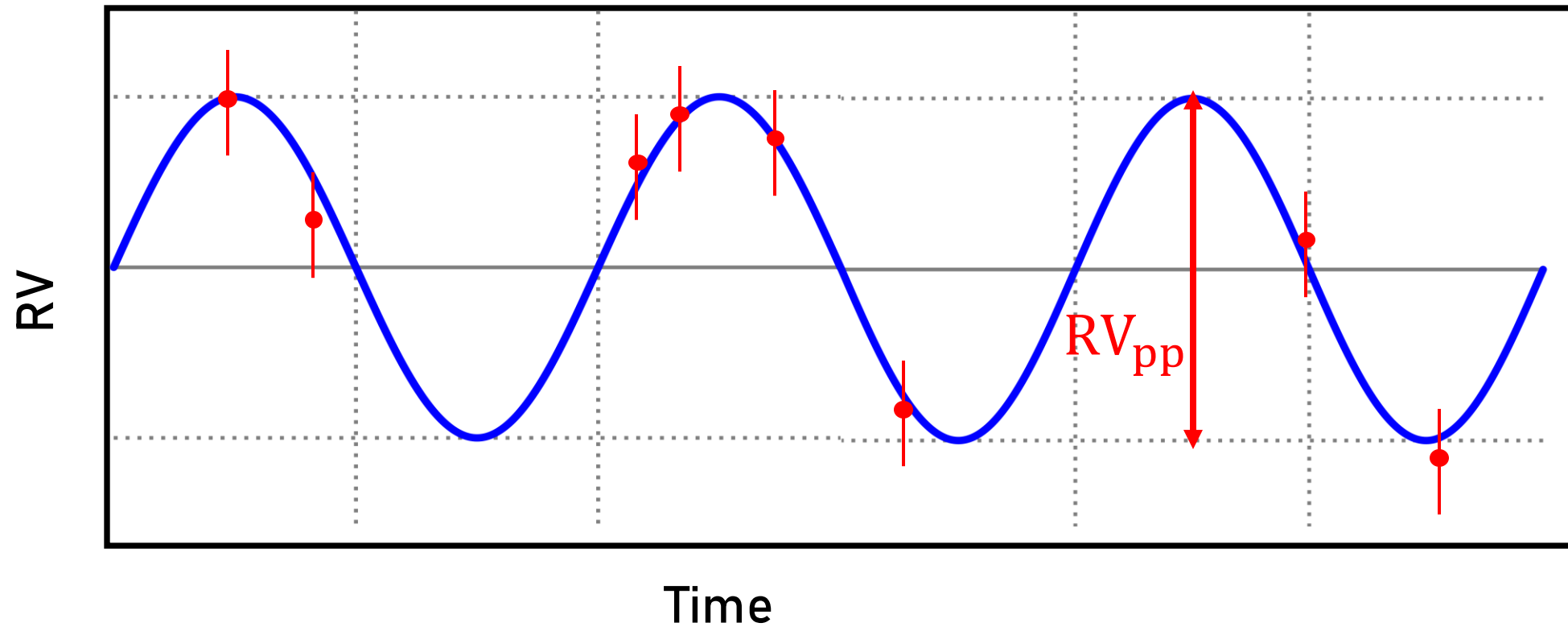# Binary fractions using *Gaia*: what we'd want

RV

Time

Binary fractions using *Gaia*: what we'd want

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Binary fractions using *Gaia*: what we'd want
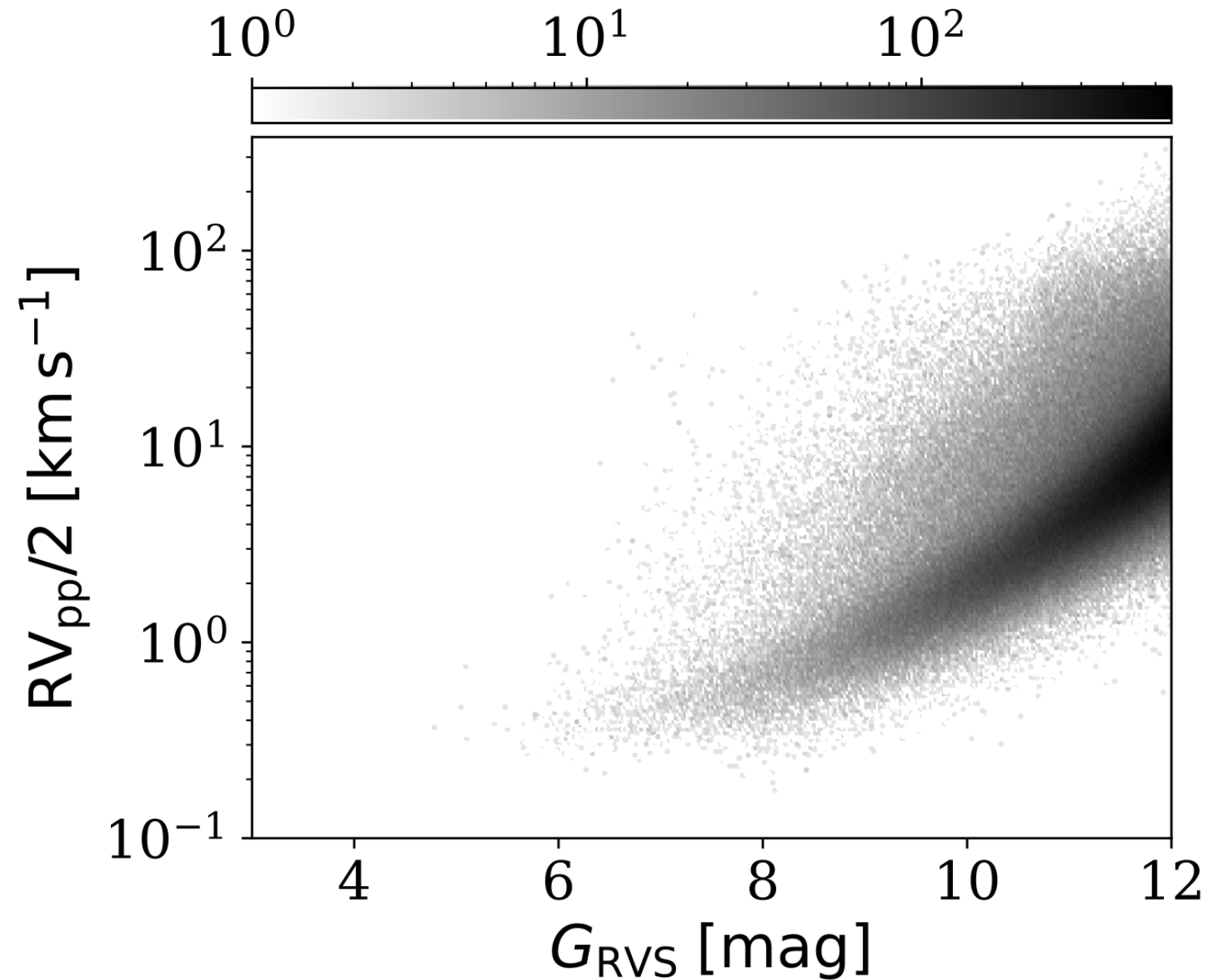
Binary fractions using *Gaia*: what we have

RV_{pp}

$G_{RVS} < 12;\ N \sim 5M$

Katz+23

Binary fractions using *Gaia*: what we have

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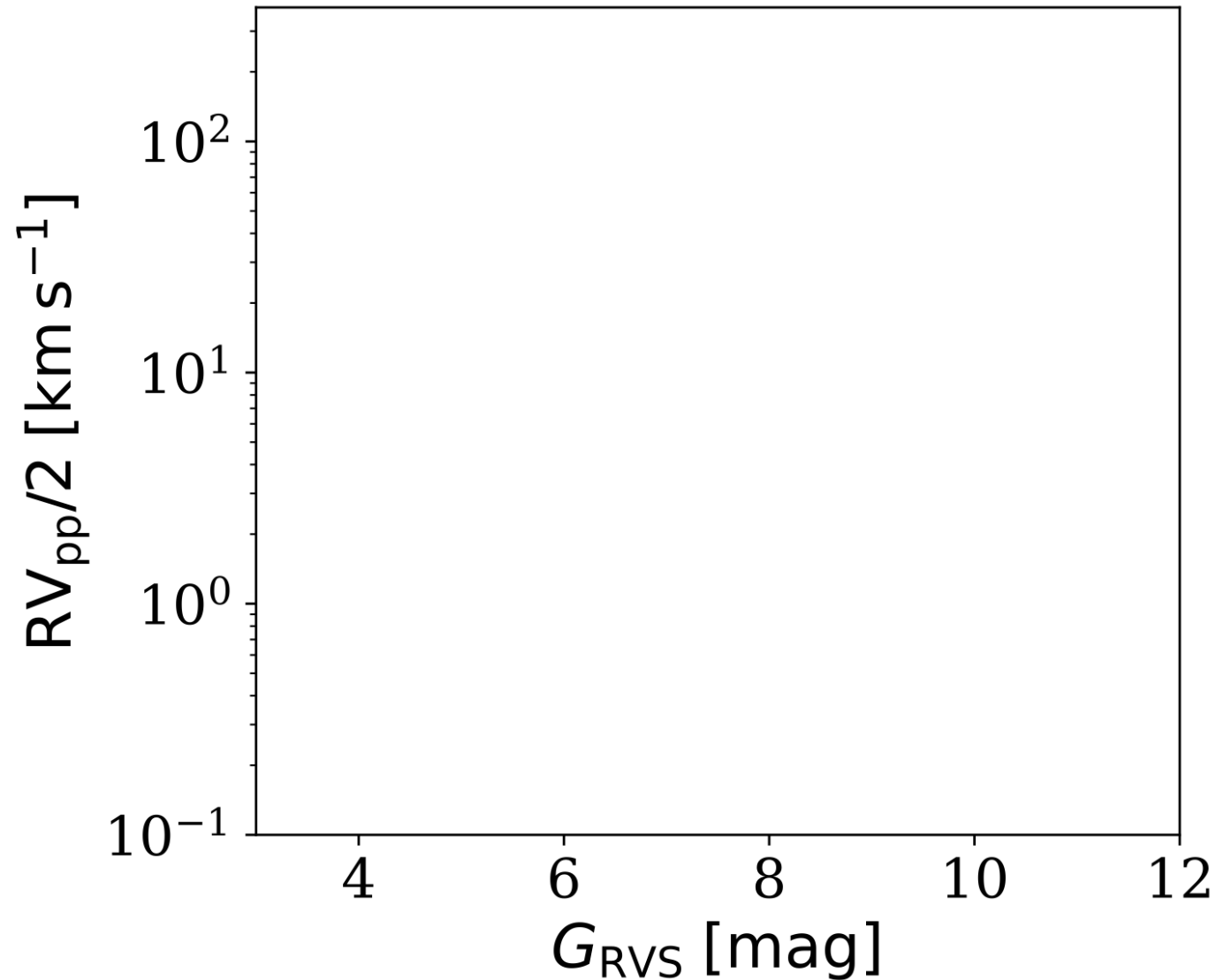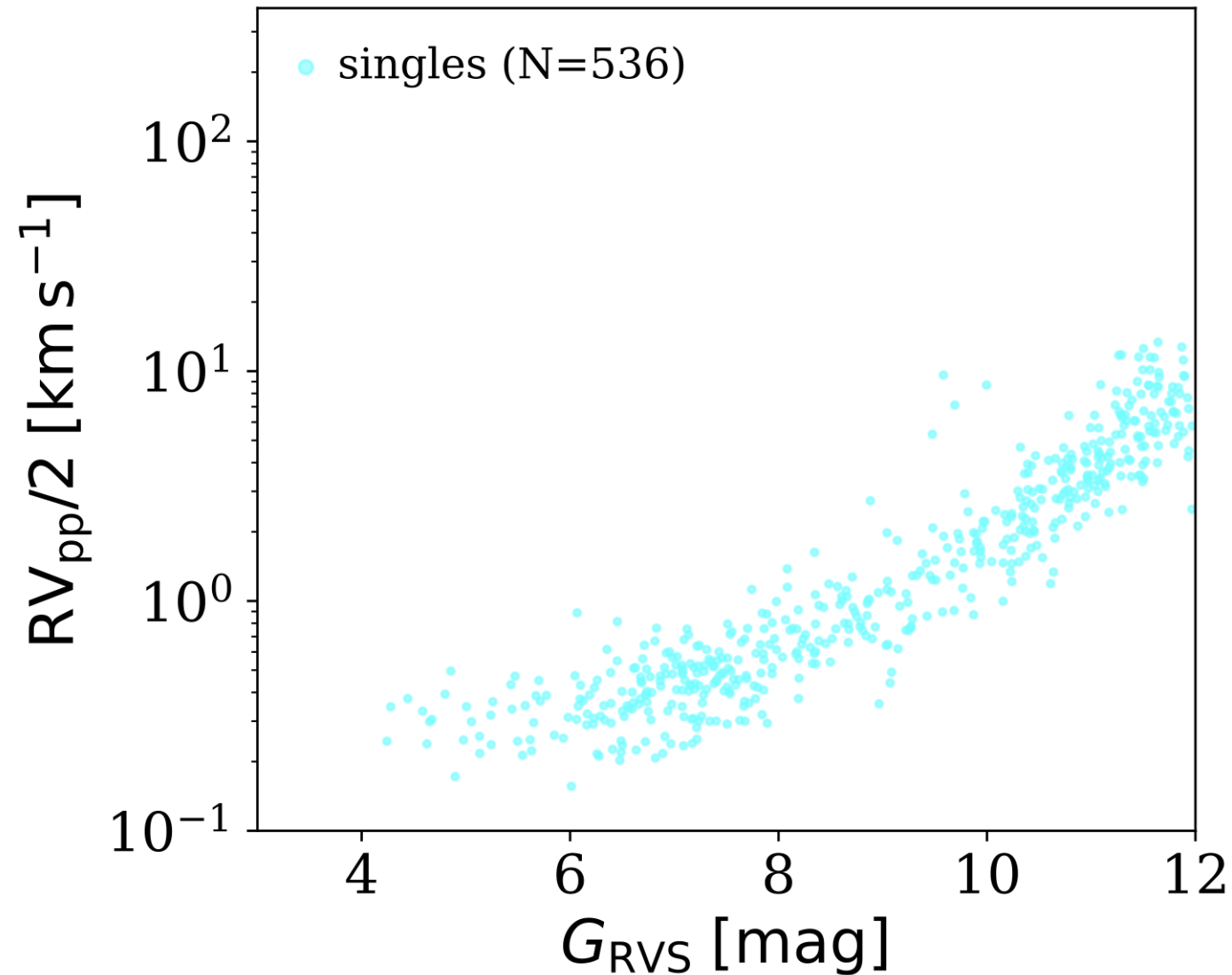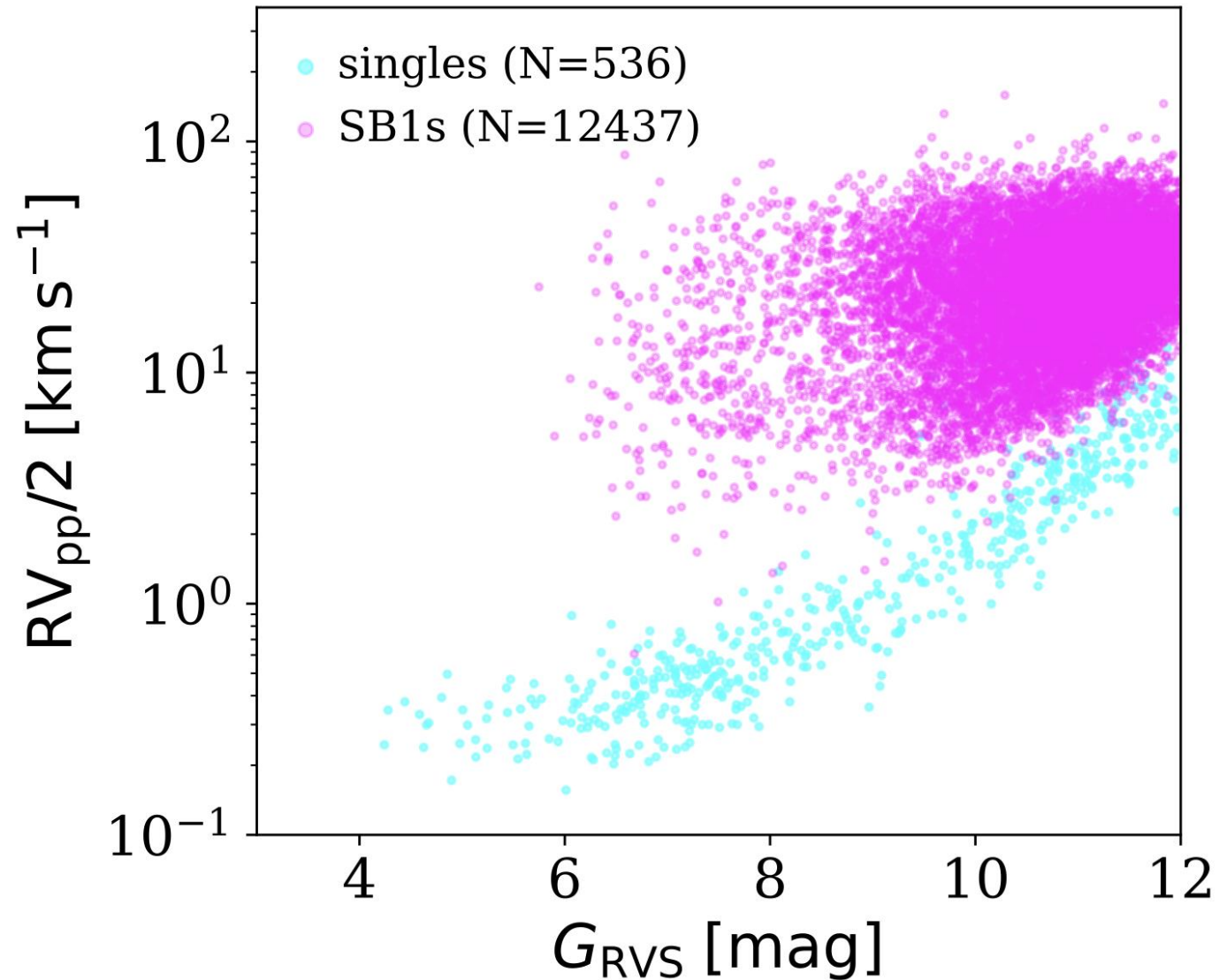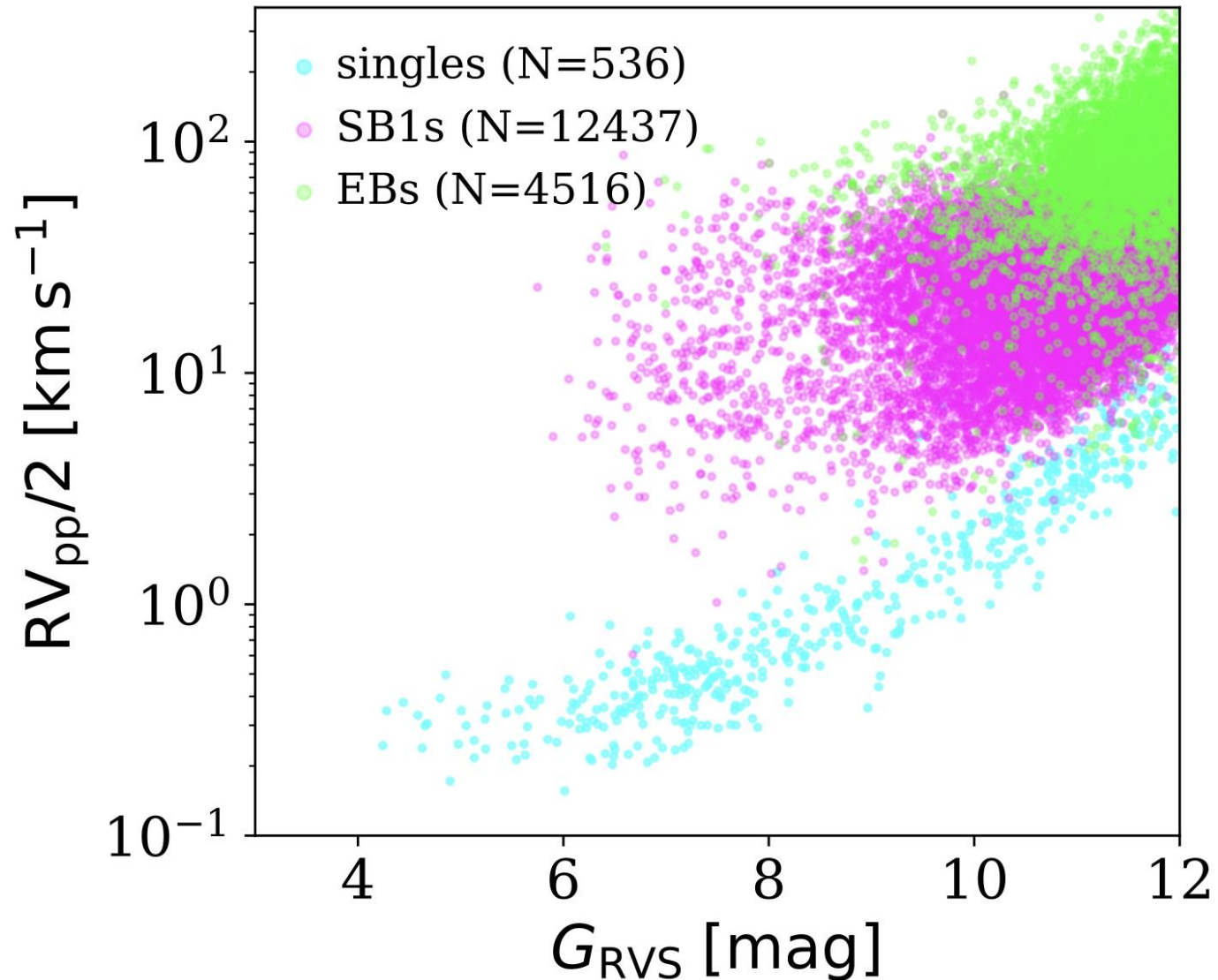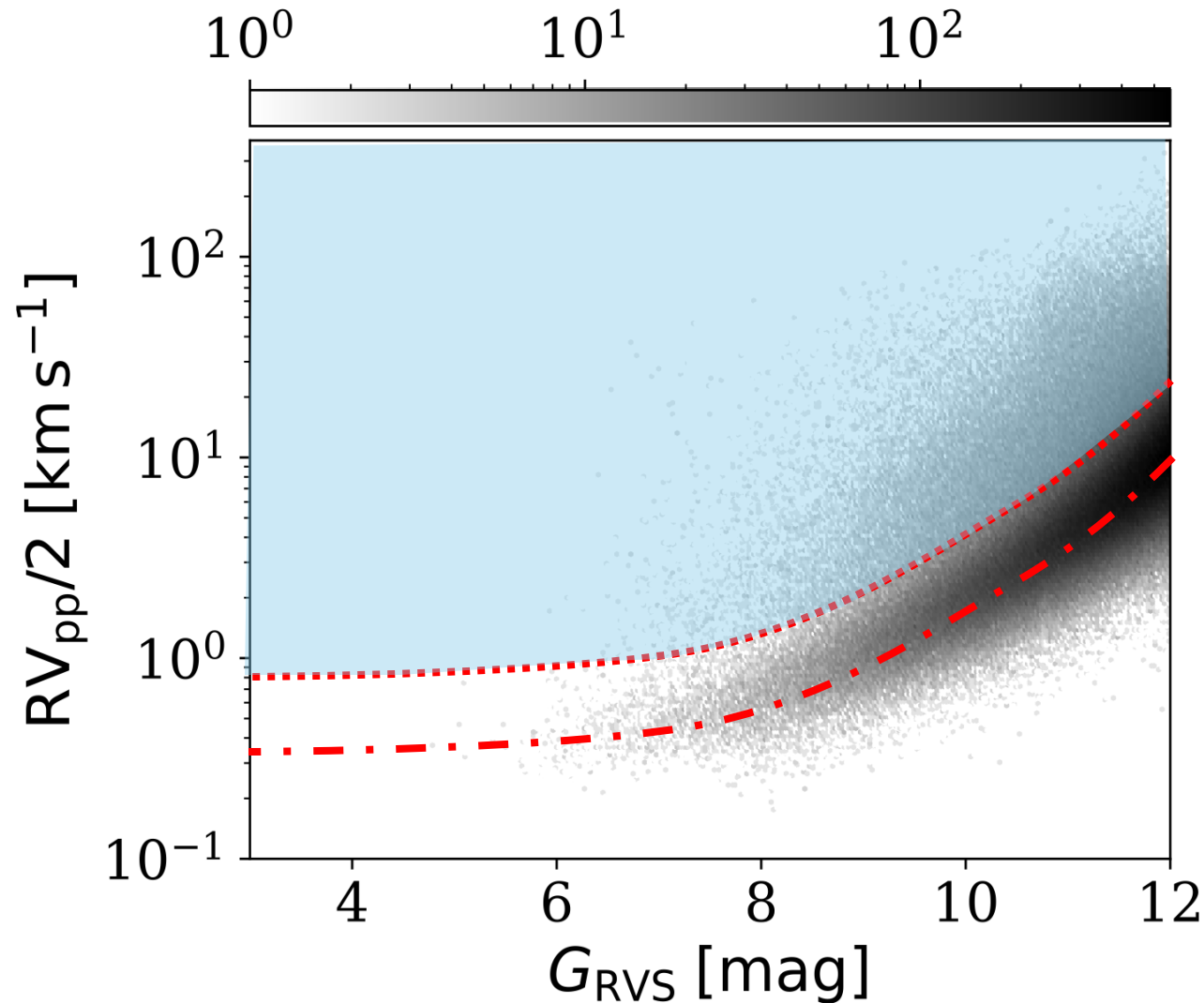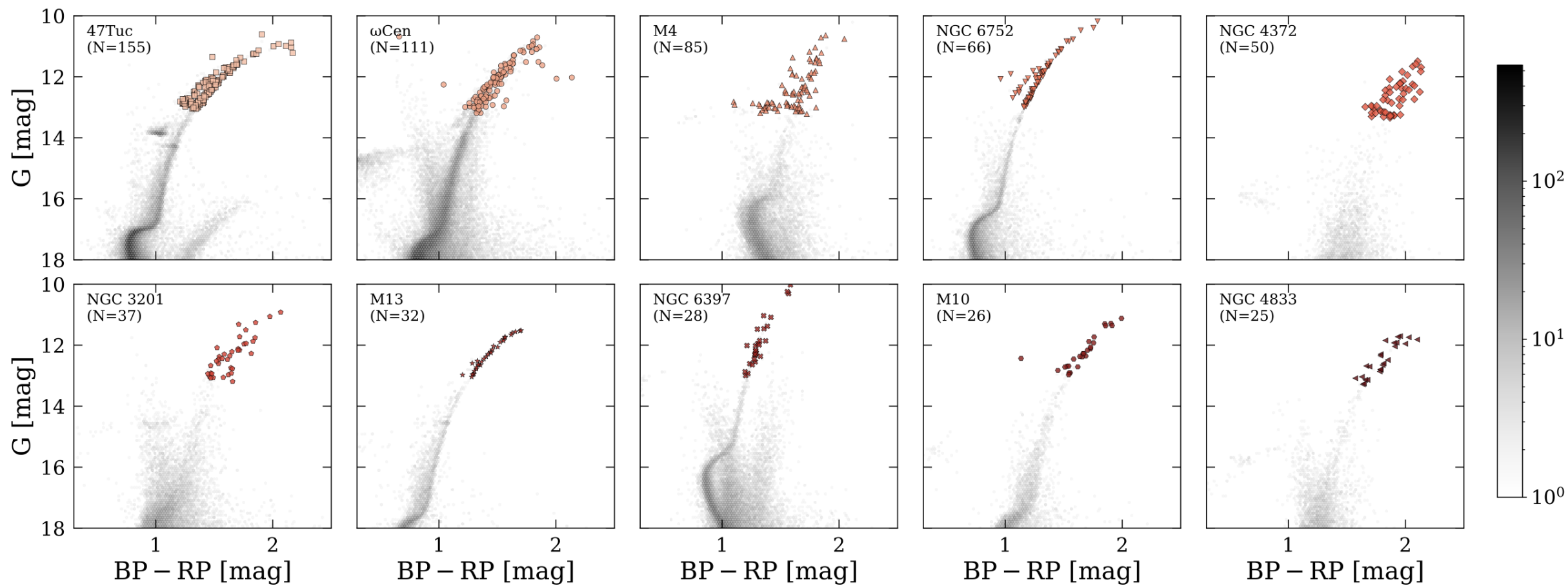
Binary fractions using *Gaia*: what we have

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We define a sum of two Gaussian distributions: one for low-$\mathrm{RV_{pp}}$ (single stars) and one for high-RV_{pp} (binary stars):

$$f(x|G_{\mathrm{RVS}}; \theta) = (1 - F) \cdot \mathcal{N}_s \left(x|\mu_s(G_{\mathrm{RVS}}), \sigma_s^2 \right)$$
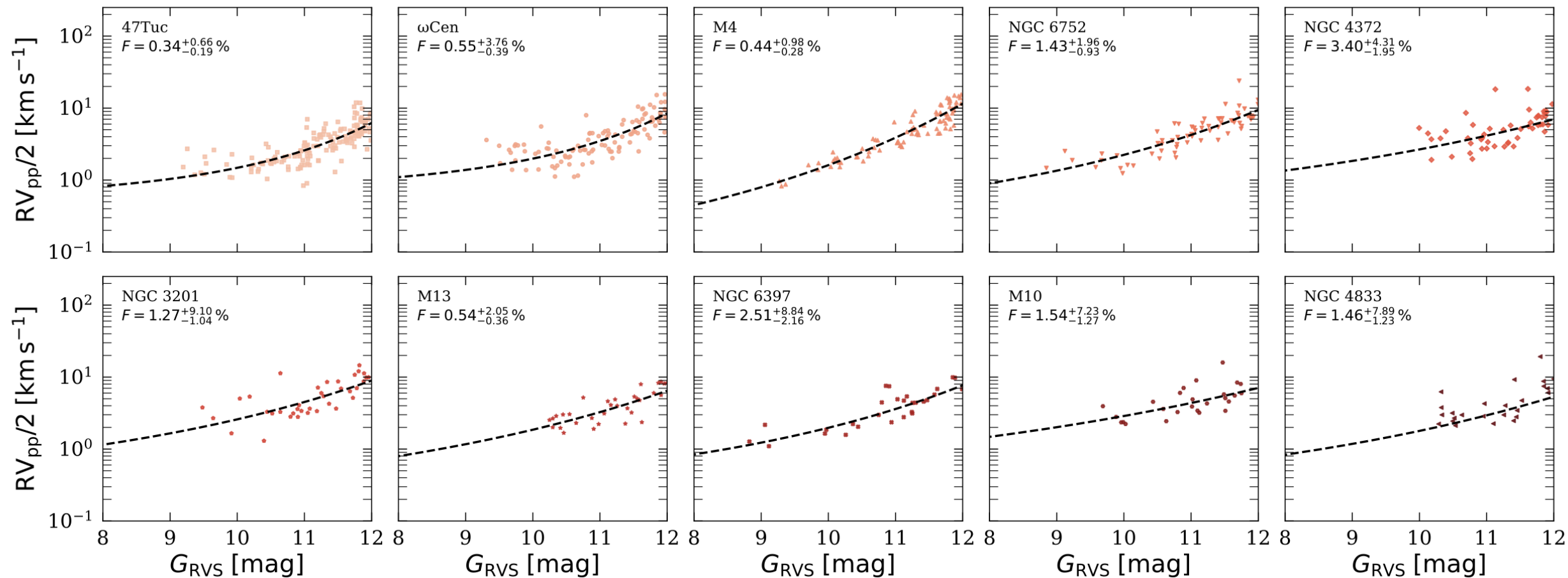$$+ F \cdot \mathcal{N}_b \left(x|\mu_b(G_{\mathrm{RVS}}), \sigma_b^2 \right),$$

$$\theta = (F, a, b, G_{\mathrm{min}}, d, \sigma_s, \sigma_b)$$
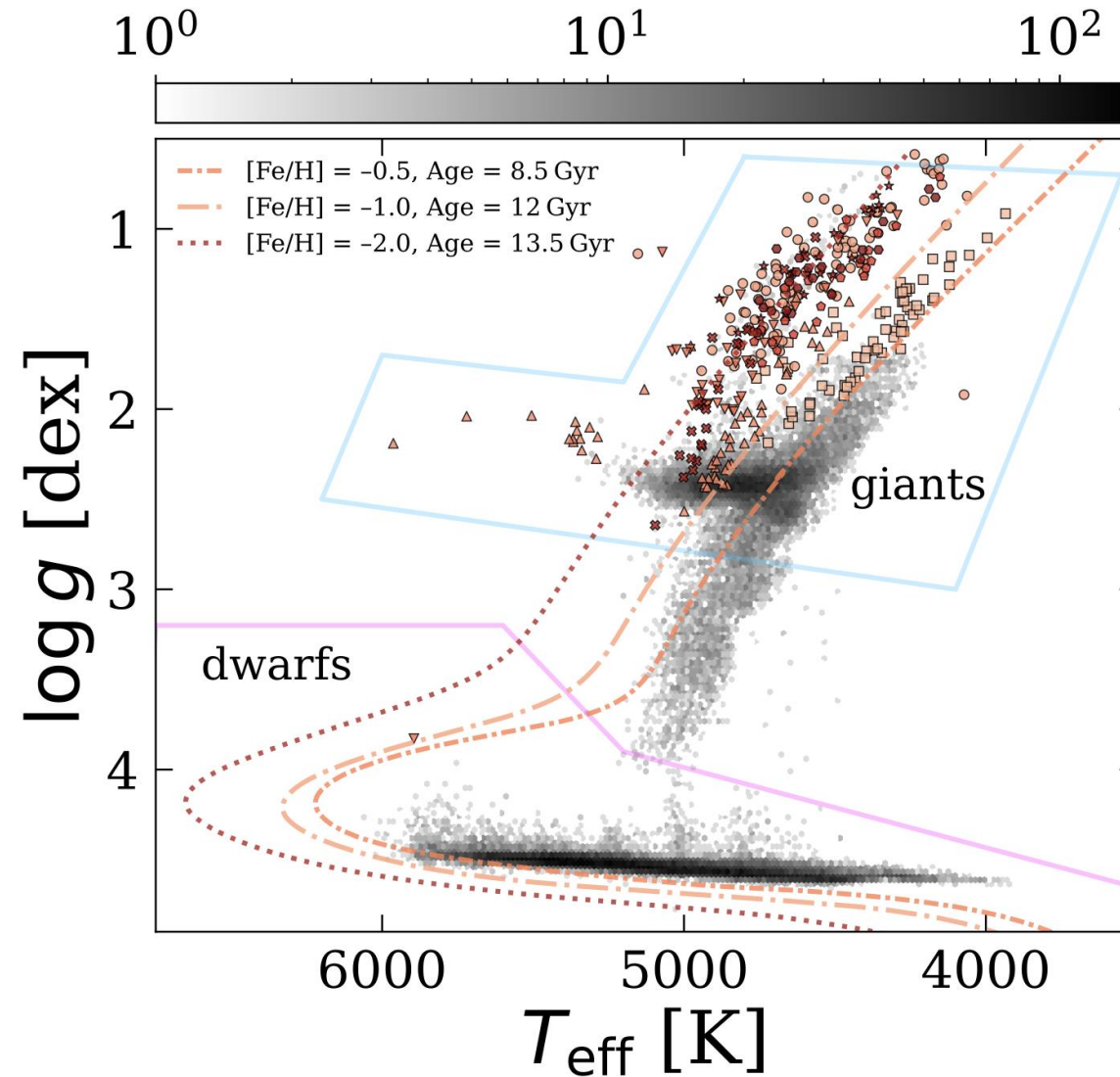
$F -$ binary fraction
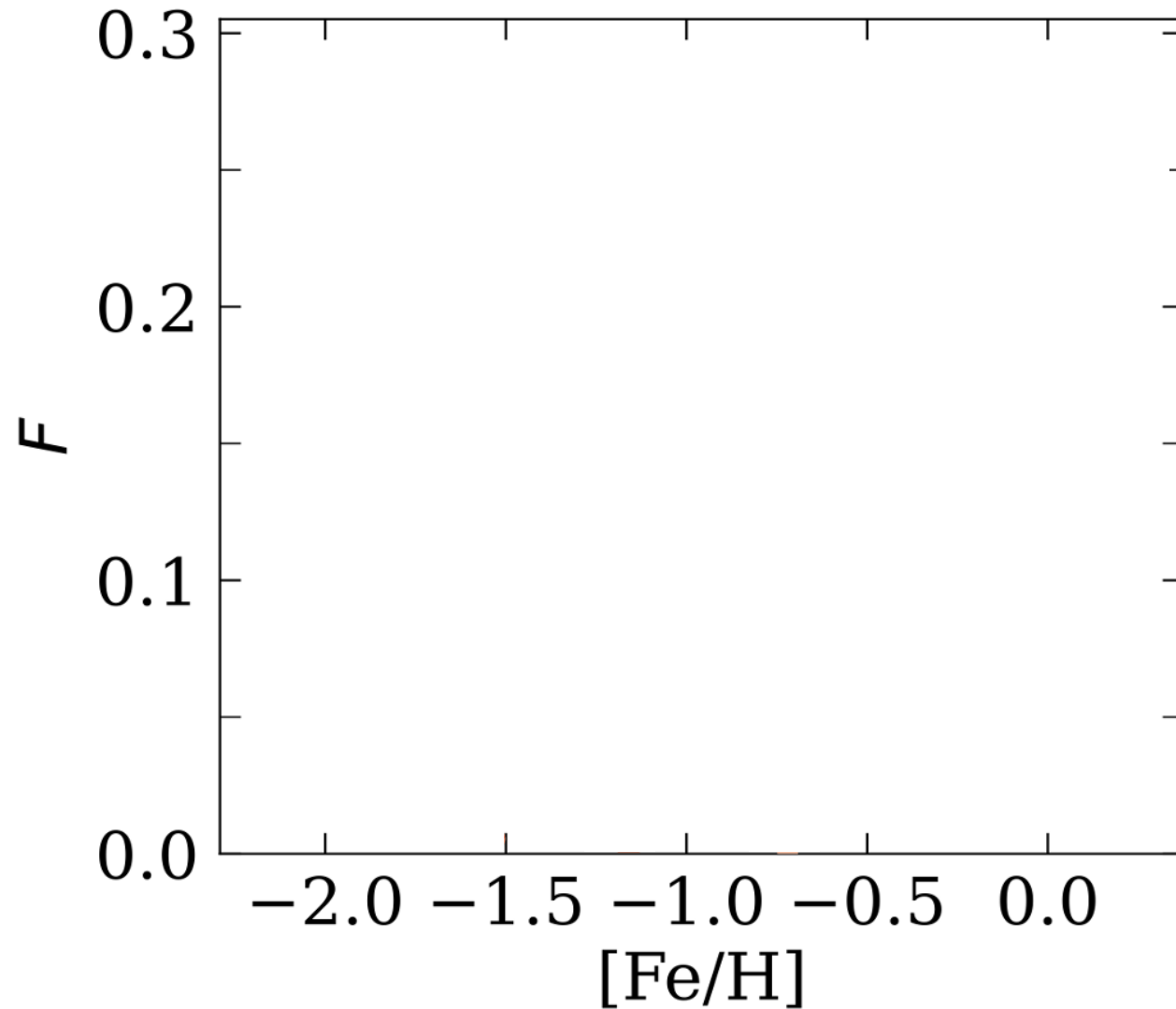
Gaia RVS view GCs

Binary fractions in GCs using *Gaia*

Binary fractions using *Gaia:* in GCs vs. Field

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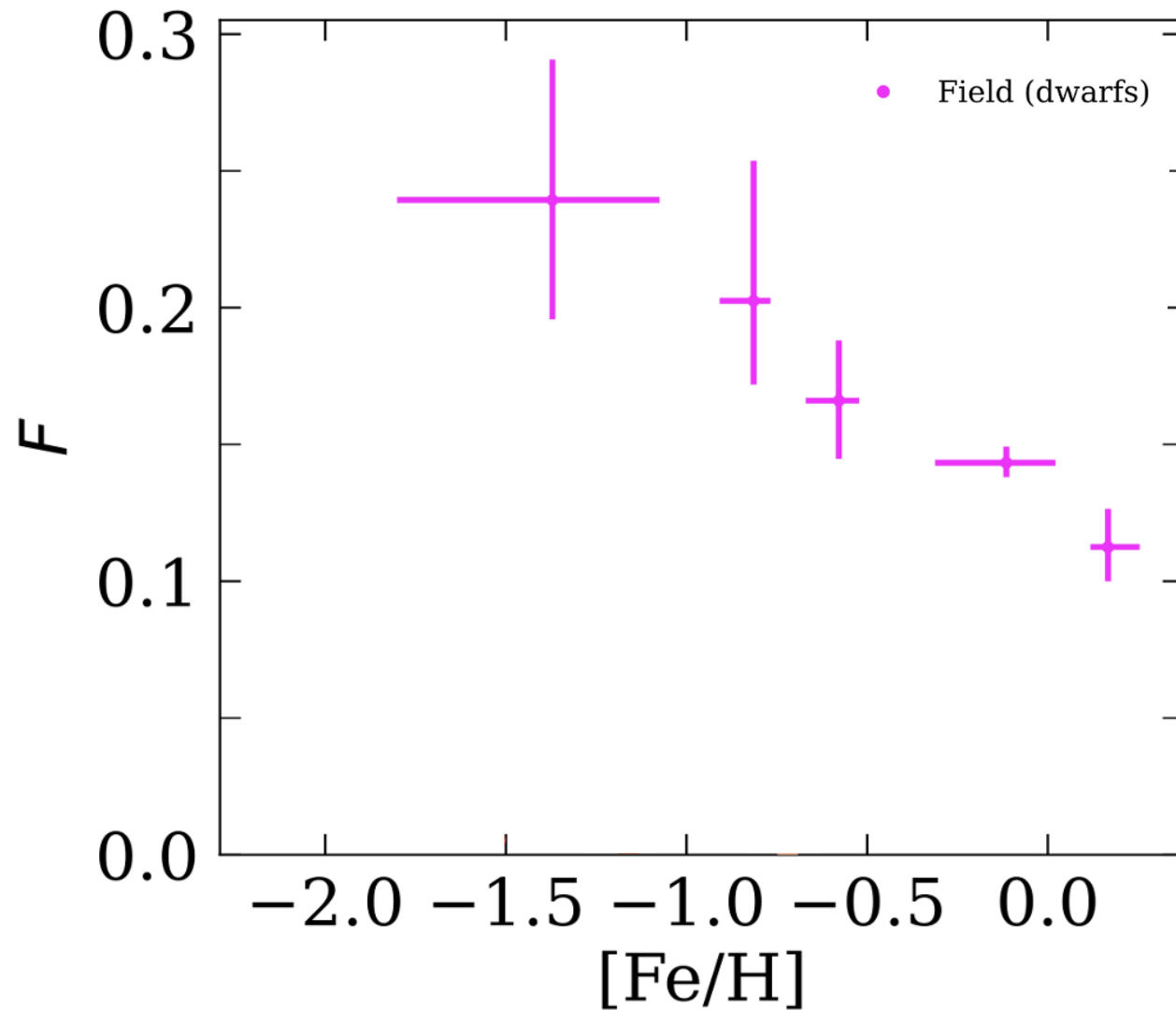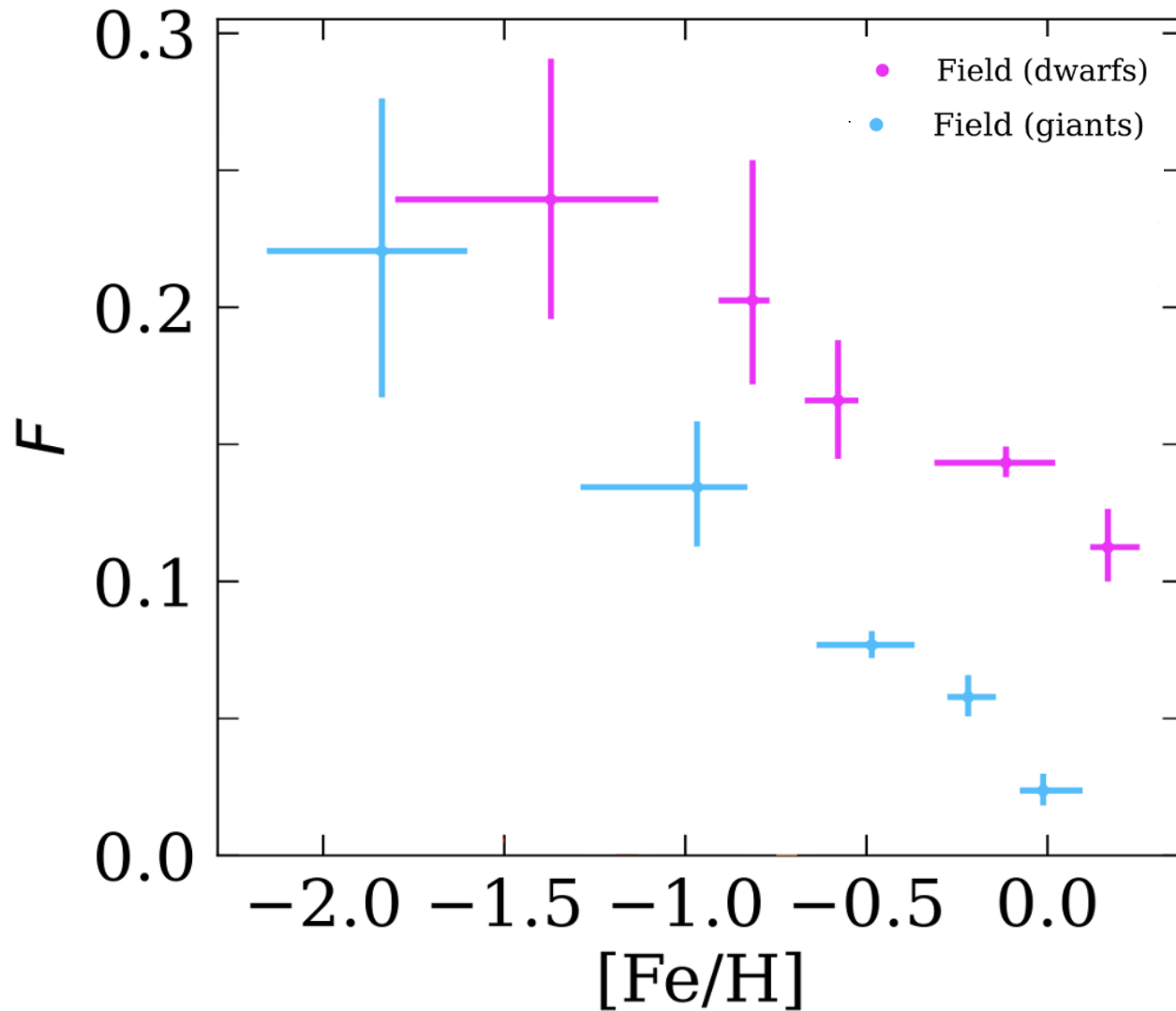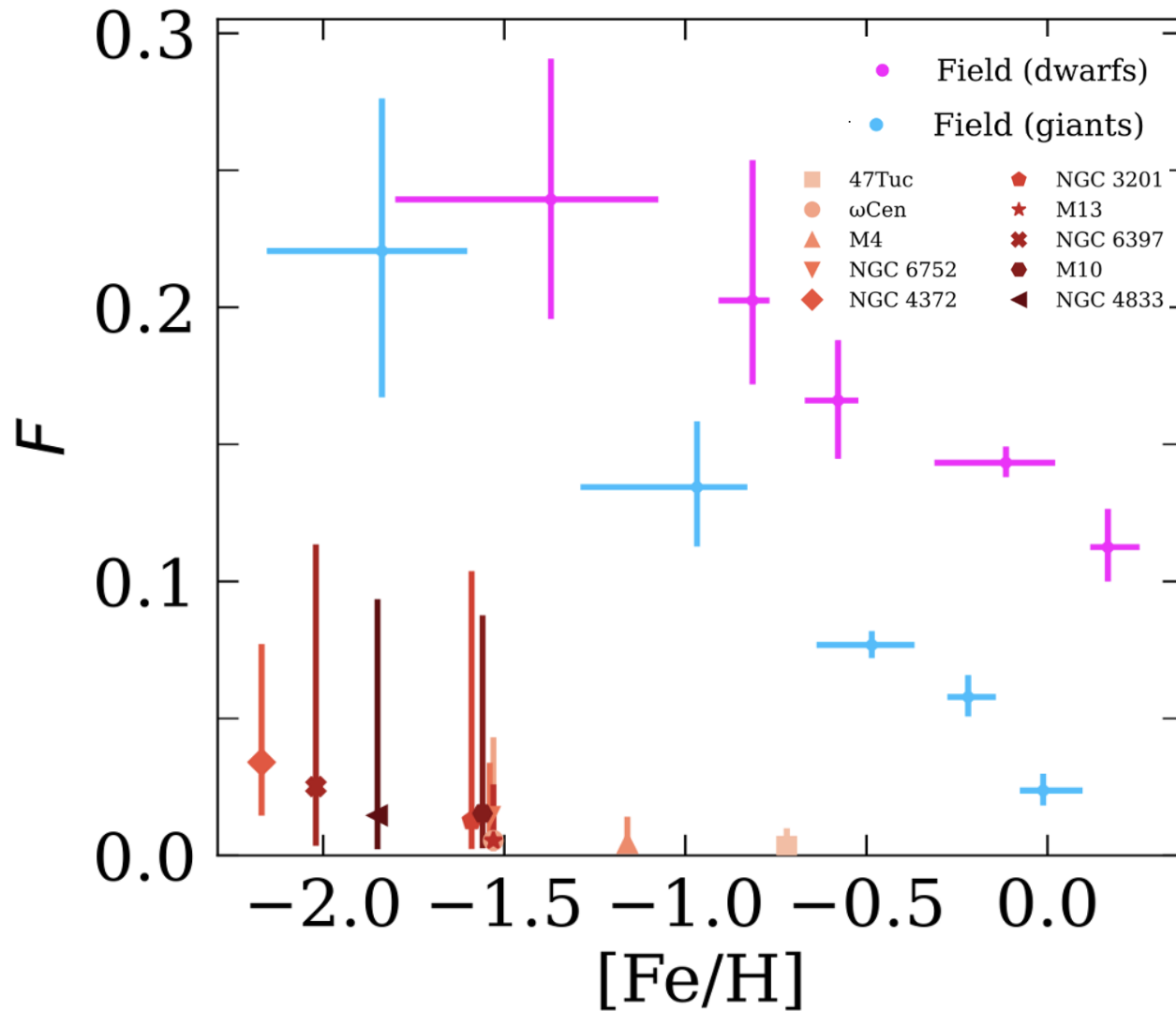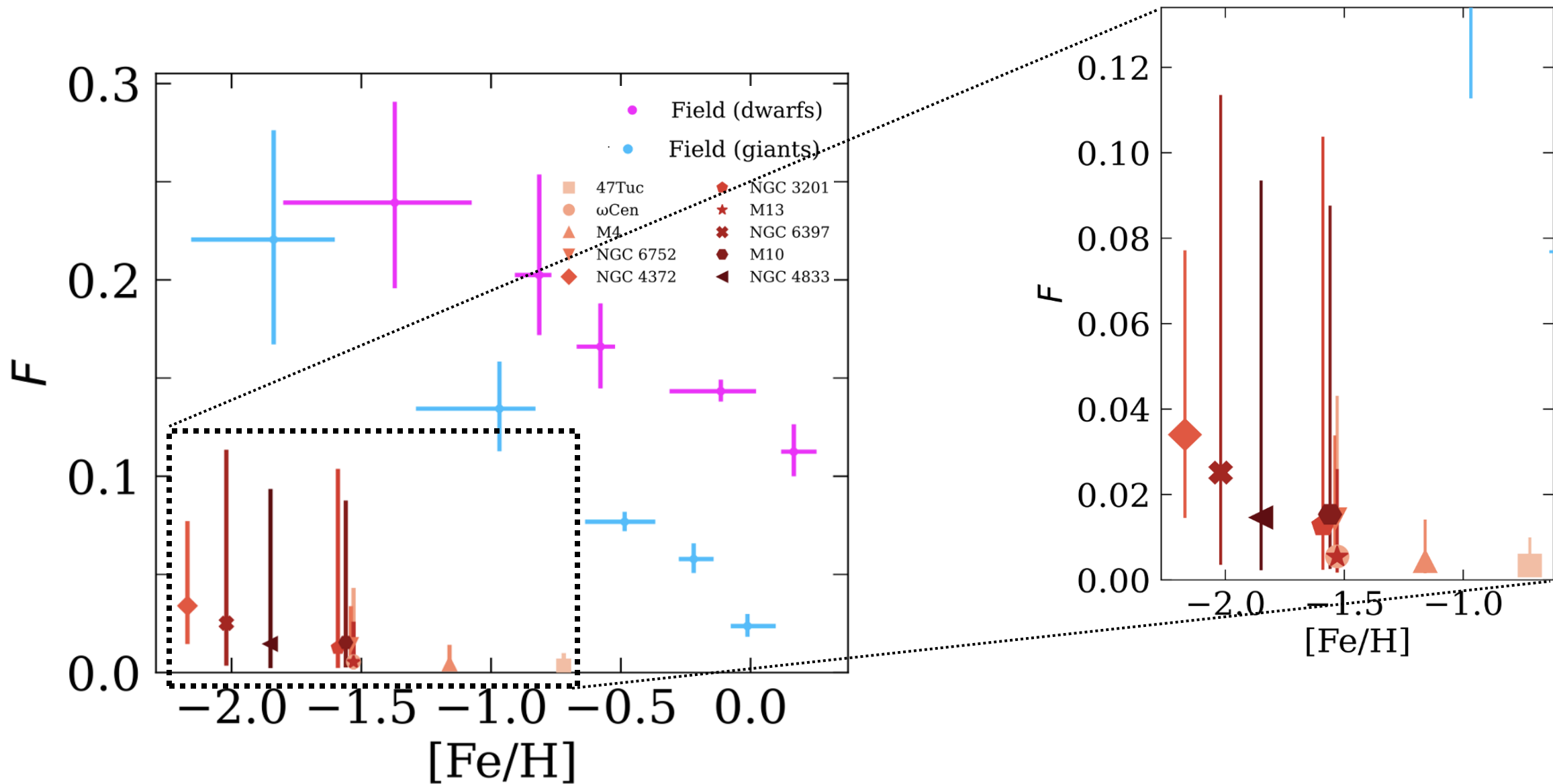# Binary fractions using *Gaia:* in GCs vs. Field

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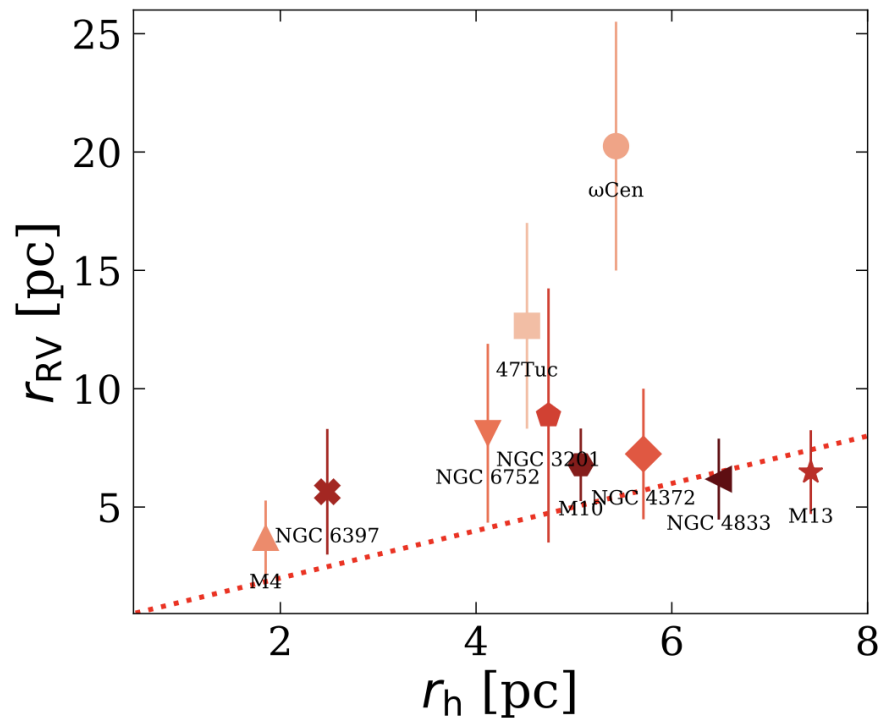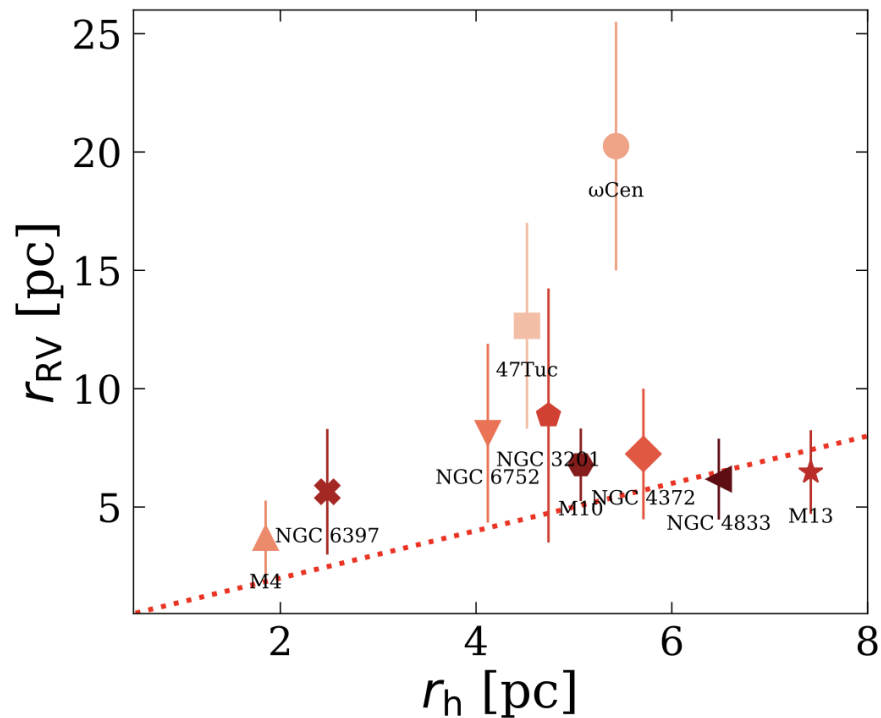# Binary fractions using *Gaia:* in GCs vs. Field

Why So Low?

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- **Dynamical disruption & hardening**
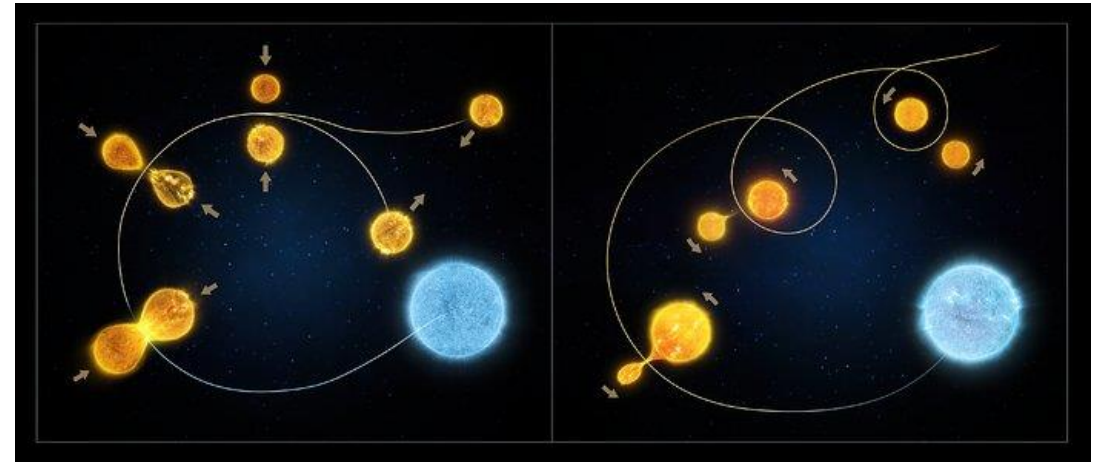
- **RV-selection bias**

Why So Low?

- **Dynamical disruption & hardening**

- **RV-selection bias**

- **Post-RGB stellar evolution**

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Take aways

- **A statistical framework to estimate binary fractions: provides a homogeneous benchmark in GCs and field stars**

- **Suggests that dynamical interactions dominate over metallicity in shaping binaries**

- **Prospect towards DR4: Gaia may ultimately enable orbital fitting of the detected binary stars**

Thanks for listening!

https://arxiv.org/abs/2507.00131

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