



# Doppler Hüzmenmesi Gösteren Çift Sistemlerde Fotometriden Dikine Hız Eldesi

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# Çift Yıldız Sistemleri

- Fotometrik Gözlemler

- Dönem ( $P$ )
- Yörünge eğim açısı ( $i$ )
- Dışmerkezlik ( $e$ )
- Kesirsel ışınım güçleri ( $L_{1,2}$ )
- Kütle oranı ( $q$ )
- ...

- Tayfsal Gözlemler

- Bileşen kütleleri ( $M_{1,2}$ )
- Yörünge yarı-büyük eksen uzunluğu ( $a$ )
- ...

# Hüzmelenme Gösteren Çiftler (Beaming Binaries)

- Fotometrik Gözlemler
  - Dikine hız genliği (Zucker vd, 2007)

$$\left(\frac{\Delta F_\nu}{F_\nu}\right)_{\text{hüzmelenme}} = \frac{1}{c} \frac{K_1[3 - \alpha_1(\nu)]F_{\nu,1} - K_2[3 - \alpha_2(\nu)]F_{\nu,2}}{F_{\nu,1} + F_{\nu,2}} \quad \alpha_\nu = 3 - \frac{d \ln F_\nu}{d \ln \nu}$$

Filtreli gözlemler için:

$$\left(\frac{\Delta F_\nu}{F_\nu}\right)_{\text{hüzmelenme}} \cong \frac{1}{c} K_1 [3 - \alpha_1(\nu)]$$

Bolometrik gözlemler için:

$$\left(\frac{\Delta F_\nu}{F_\nu}\right)_{\text{hüzmelenme}} \cong \frac{4}{c} K_1$$

# Hüzmelenme Gösteren Çiftler (Beaming Binaries)

- Fotometrik Gözlemler
  - Yörünge eğim açısının ( $i$ ) fonksiyonu olarak kütle oranı ( $q$ )

$$a = (M_1 + M_2)^{1/3} (P)^{2/3} \quad K_1 = \left( \frac{M_2}{M_1 + M_2} \right) a^{-1/2} 29.8 \text{ km/s}$$

$$K_1^3 = \frac{q^3}{(1+q)^2} \frac{2\pi G M_1}{P} \sin^3 i$$

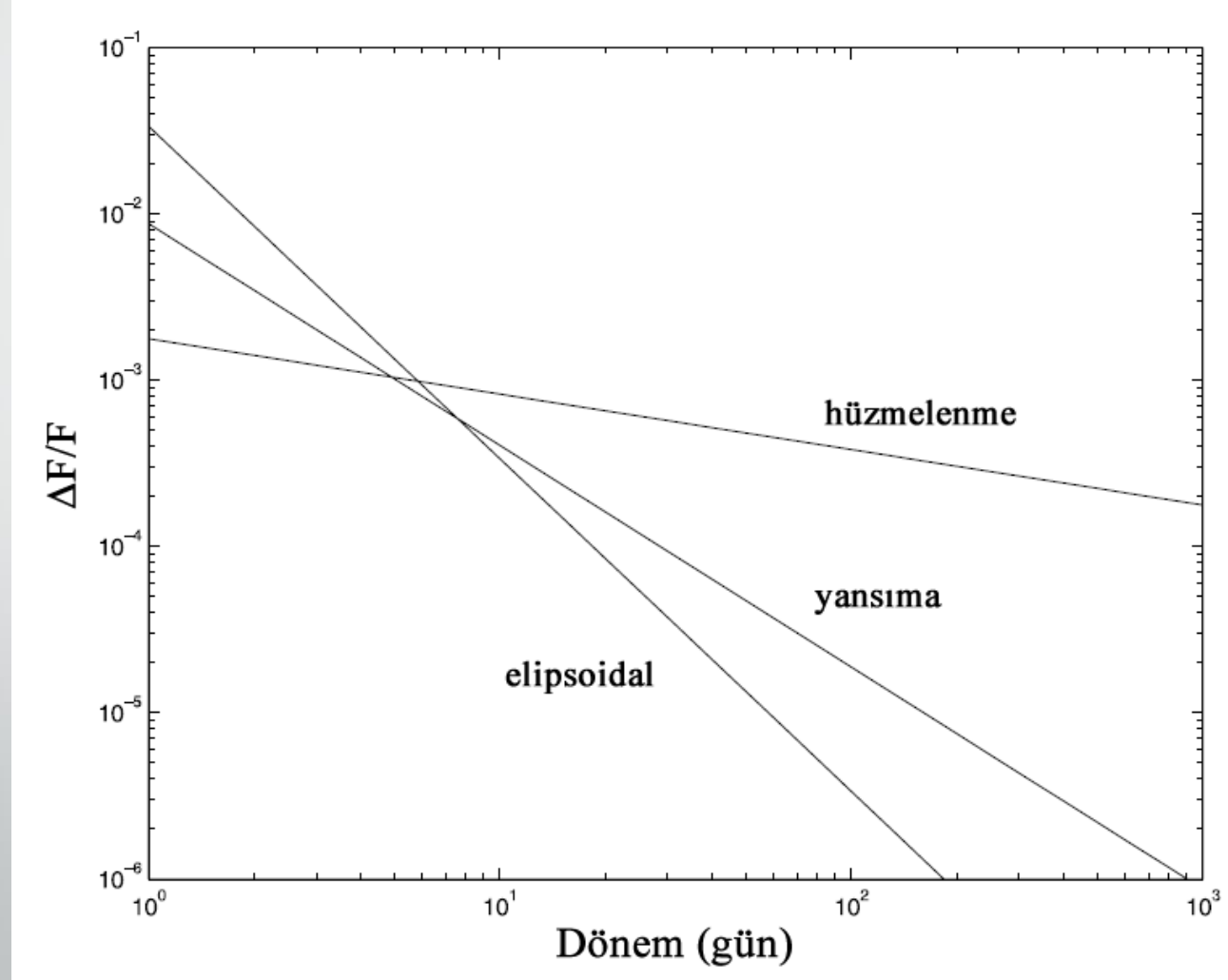
# Şekil Bozulması ve Yansımaya Etkileri

- *Morris & Naftilan (1993)*

- $\left(\frac{\Delta F_{v,1}}{F_{v,1}}\right)_{elipsoidal} \cong 0.3 \frac{(15+u_1)(1+\tau_1)}{3-u_1} \frac{M_2}{M_1} \left(\frac{R_1}{a}\right)^3$

- $\left(\frac{\Delta F_v}{F_v}\right)_{yansima} = \frac{2}{3} \frac{\left(\frac{R_2}{a}\right)^2 f_{\lambda}^{-1} F_{v,1} - \left(\frac{R_1}{a}\right)^2 f_{\lambda} F_{v,2}}{F_{v,1} + F_{v,2}}$

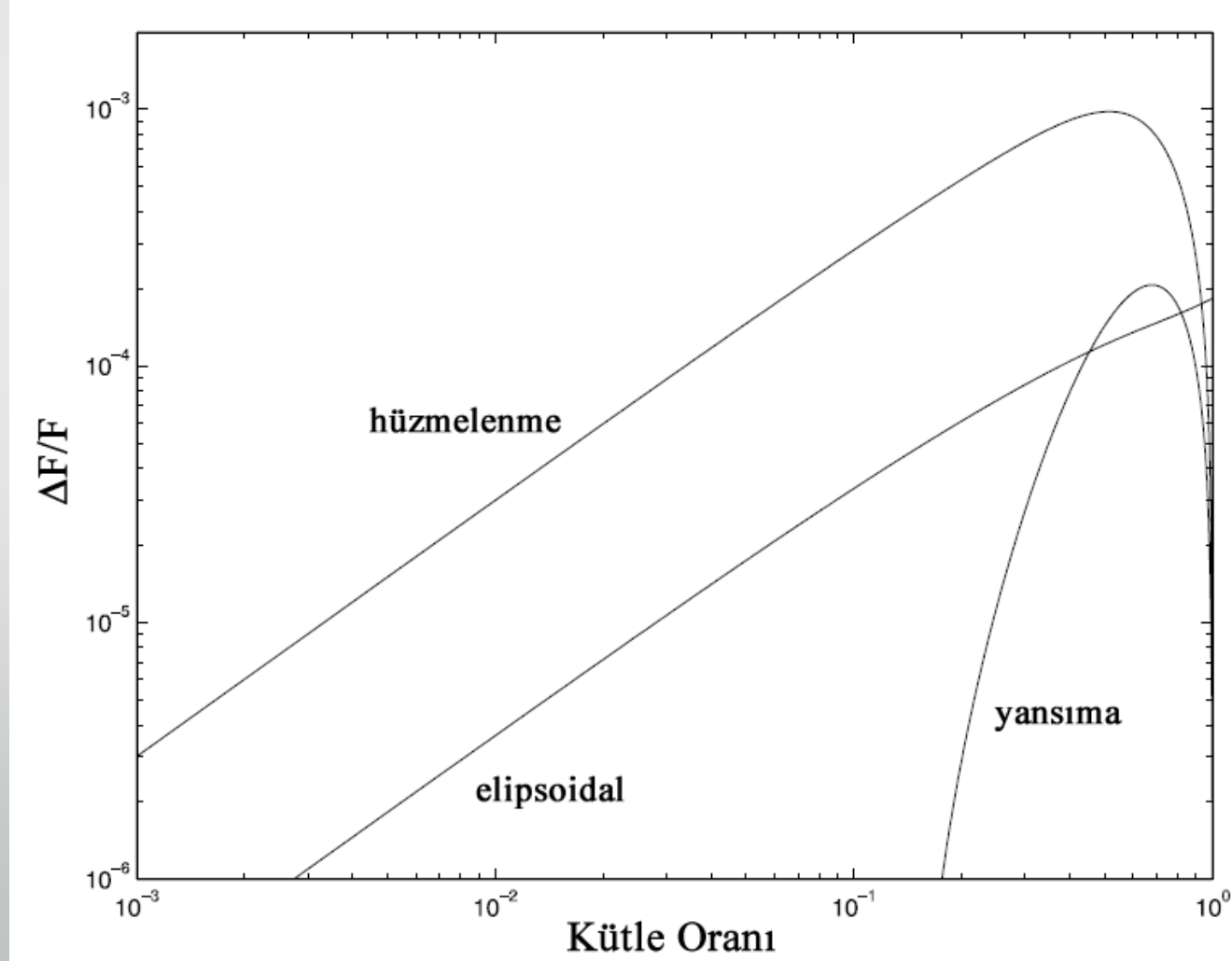
# Hüzmelenme- Yansıma-Şekil Bozulması



F0+K0

(Zucker vd 2007)

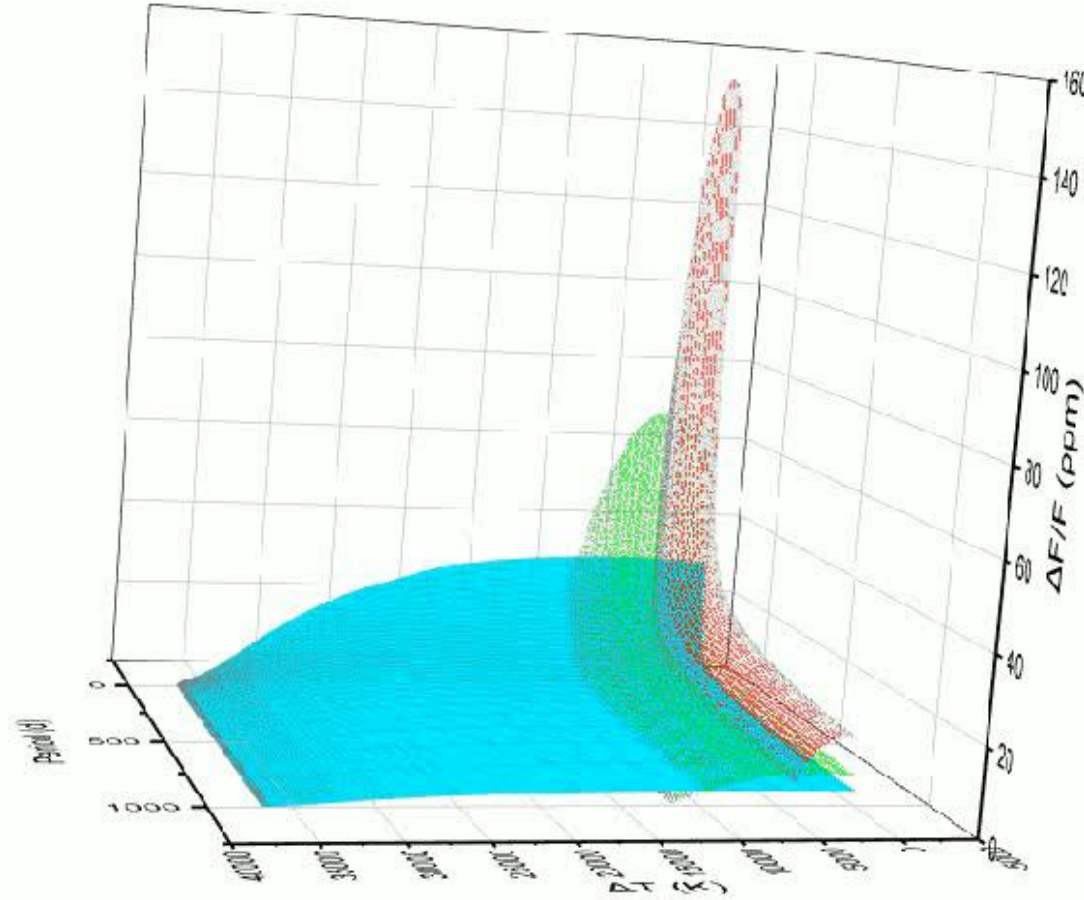
# Hüzmelenme- Yansıma-Şekil Bozulması



Baş bileşen: G0

(Zucker vd 2007)

# P- $\Delta T$ Düzleminde Hızın Genliği



$T_1 = 7000$  K

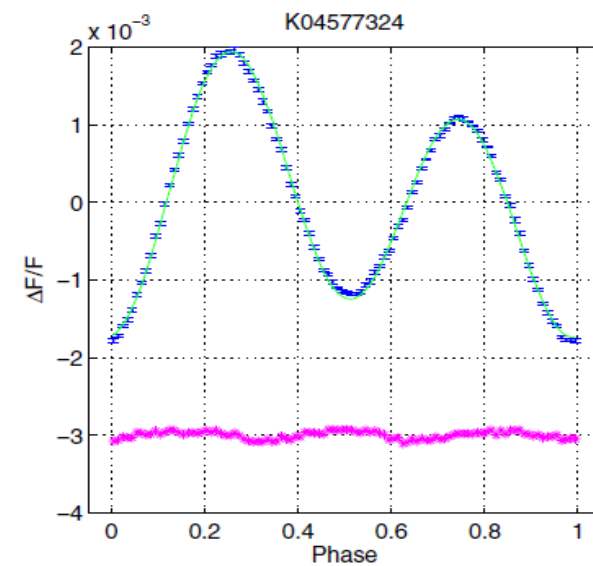
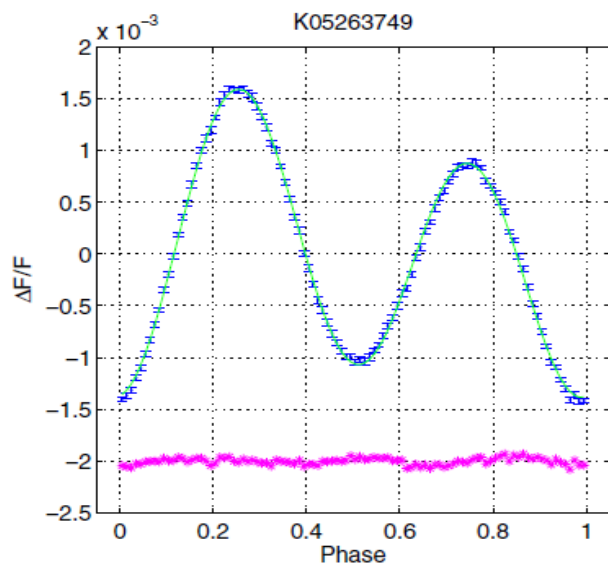
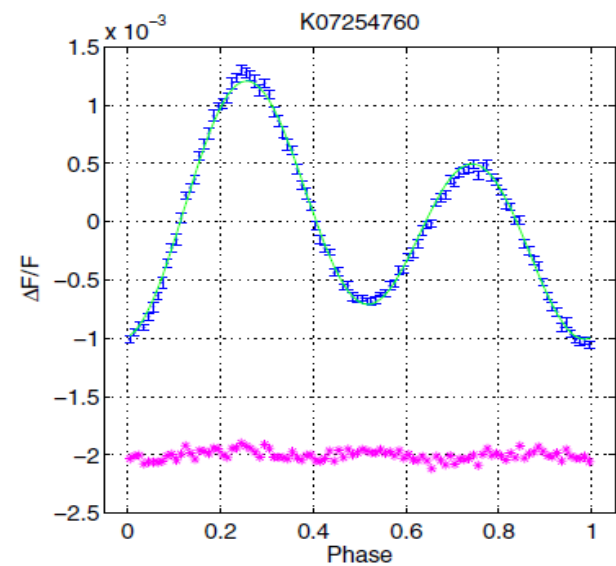
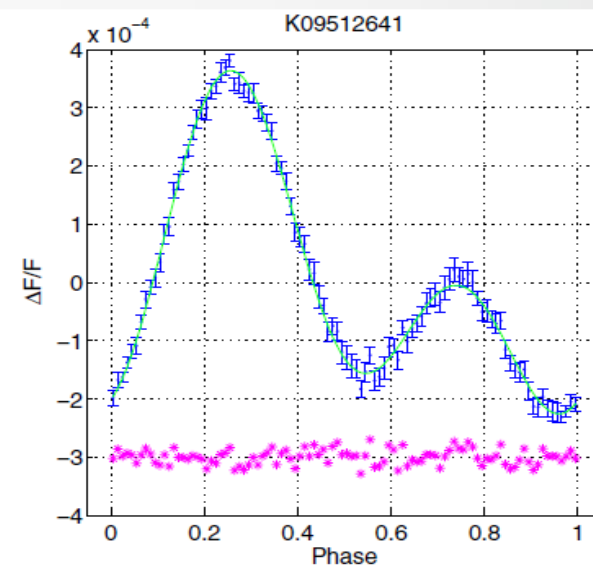
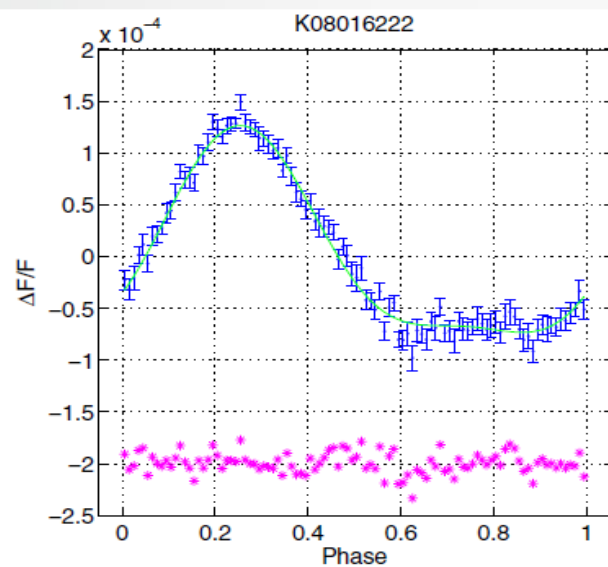
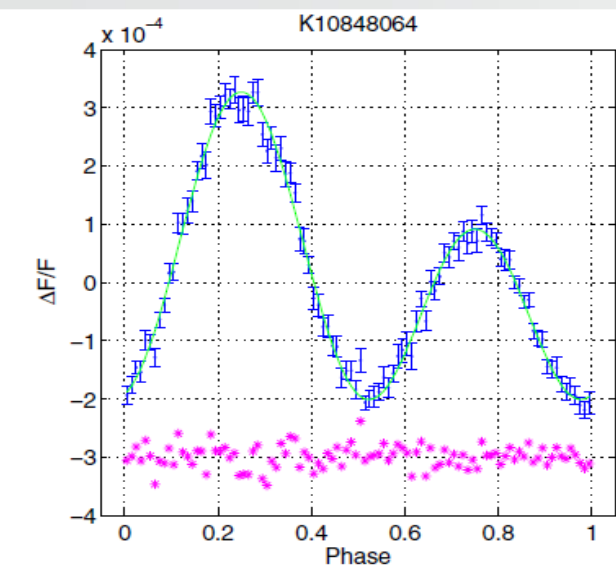
$T_1 = 15000$  K

$T_1 = 40000$  K

$3200$  K  $\leq T_2 \leq T_1$

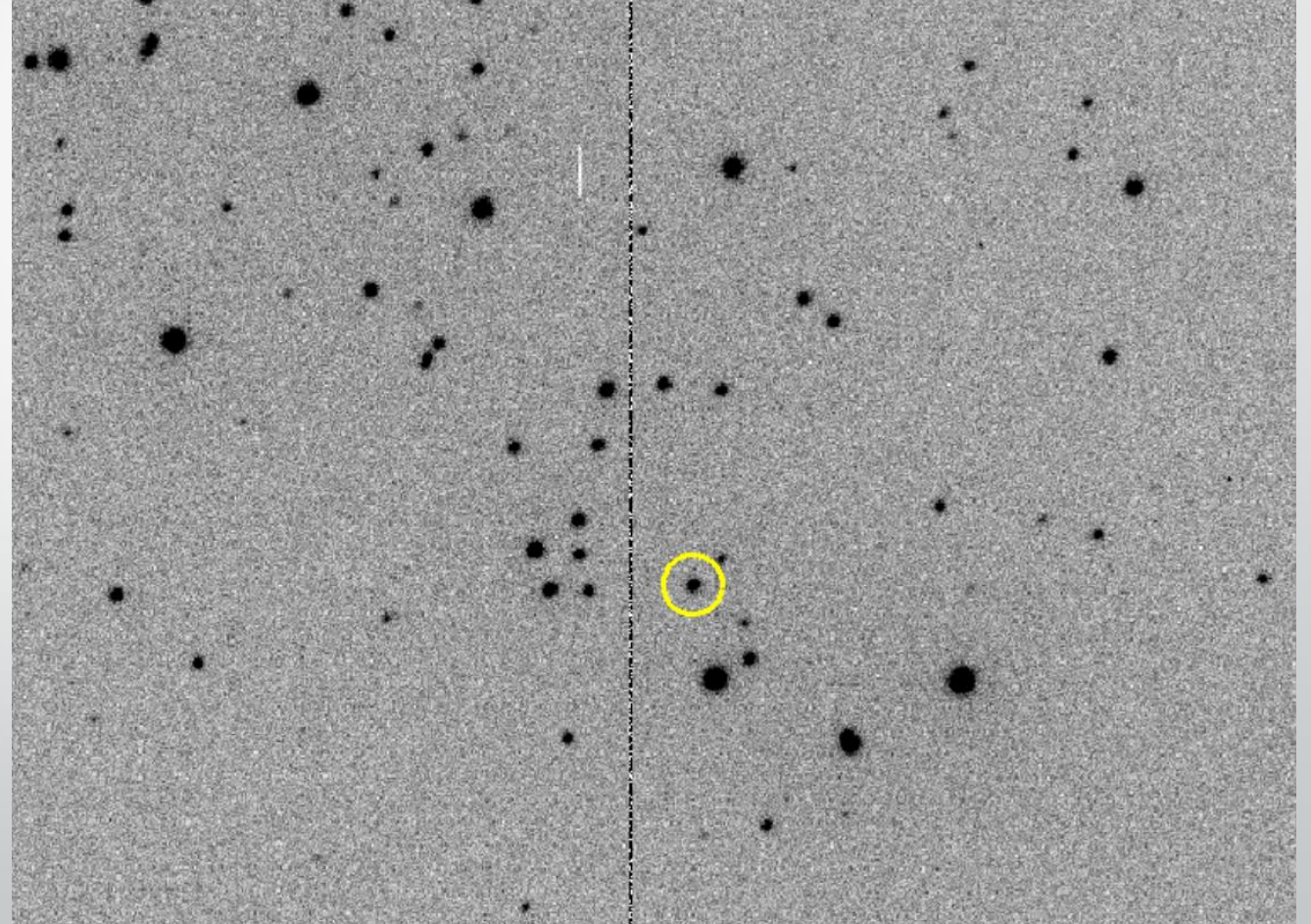


# Faigler vd (2012)



# HV Cnc

- EPIC 211408138
- $m_{\text{Kepler}} = 12^{\text{m}}.74$
- $P = 10.338$  gün
- M67 üyesi
- Kepler PDC-SAP verileri,  
27 Nisan-10 Temmuz 2015



# HV Cnc

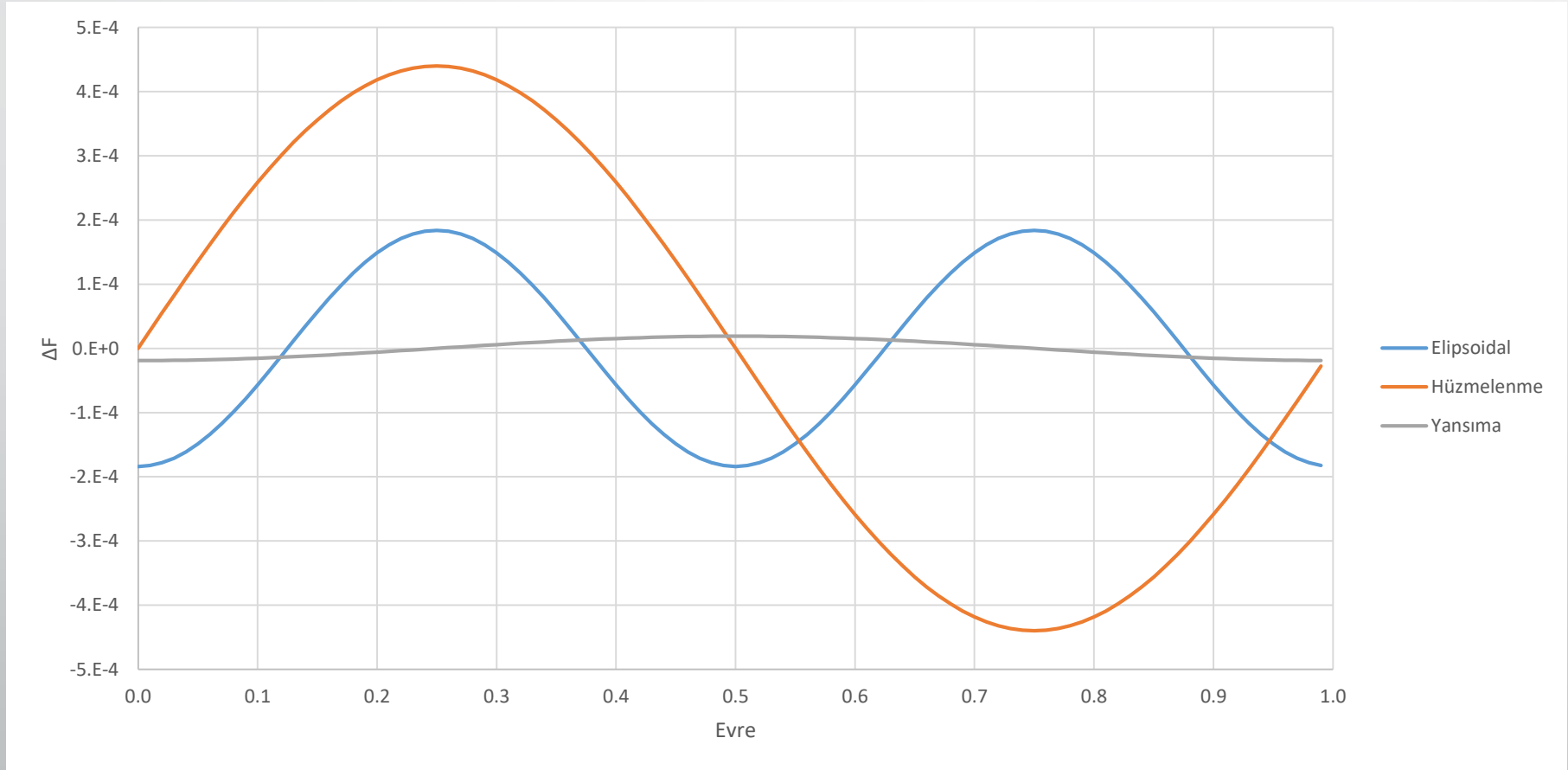
- 6400 K – 3818 K (~F7V – Mo.5V)

$$\frac{\Delta F}{F} = a_0 - A_{Ref} \cos\left(\frac{2\pi}{P_{orb}} \hat{t}\right) + A_{Beam} \sin\left(\frac{2\pi}{P_{orb}} \hat{t}\right) - A_{Ellip} \cos\left(\frac{2\pi}{P_{orb}/2} \hat{t}\right) + A_{2s} \sin\left(\frac{2\pi}{P_{orb}/2} \hat{t}\right)$$

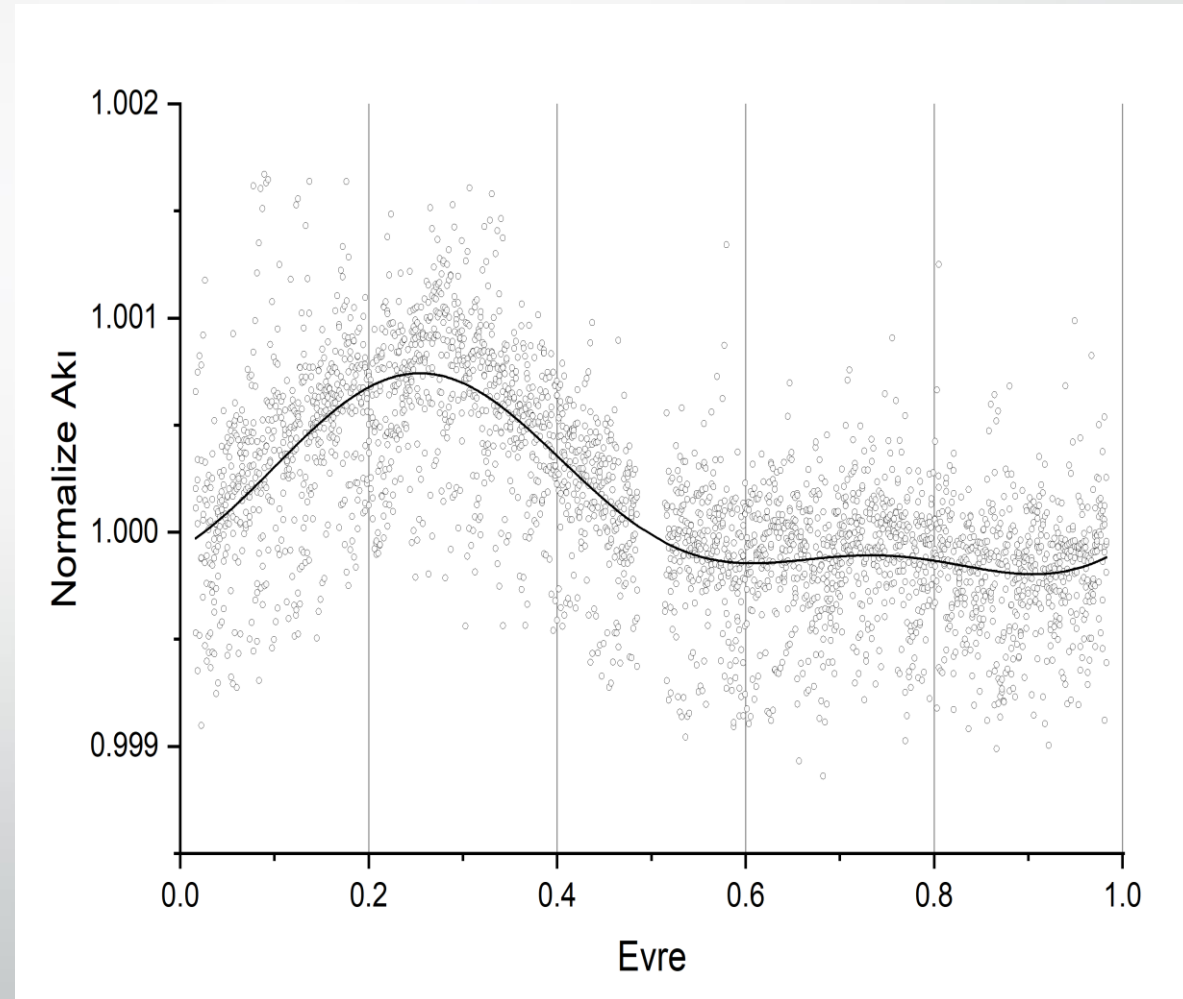
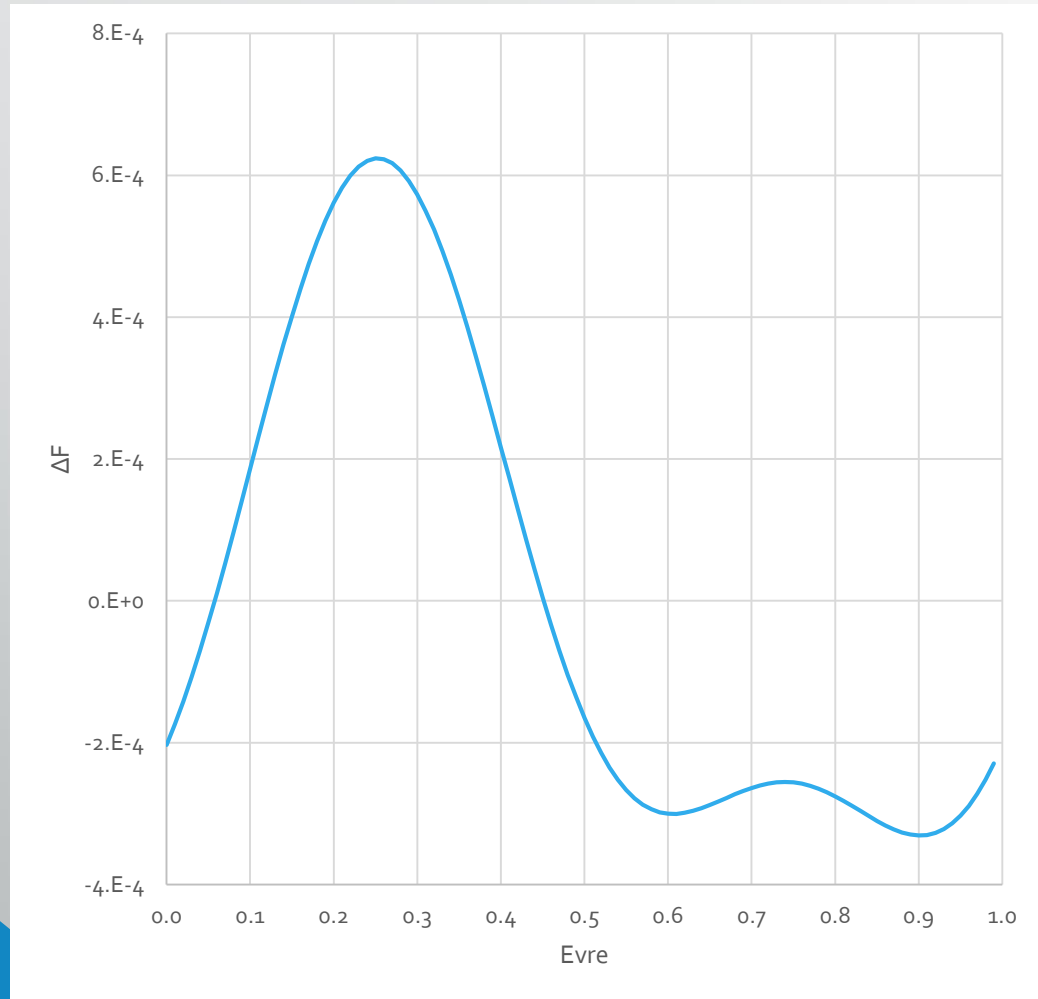
Faigler & Mazeh (2011)

| Parametre  | Değeri         |
|--|----------------|
| $A_{hüzmelenme}$ (ppm)                                   | $440 \pm 8$    |
| $A_{elipsoidal}$ (ppm)                                   | $184 \pm 6$    |
| $A_{yansima}$ (ppm)                                      | $19 \pm 9$     |
| $V_{r,1}$ (km/s) (hüzmelenme)                            | $38.7 \pm 0.7$ |
| $V_{r,1}$ (km/s) (tayfsal, (Sandquist & Shetrone, 2003)) | $33.8 \pm 0.2$ |

# HV Cnc



# HV Cnc





Teşekkürler