Mapping the Orbit of Iota Orionis

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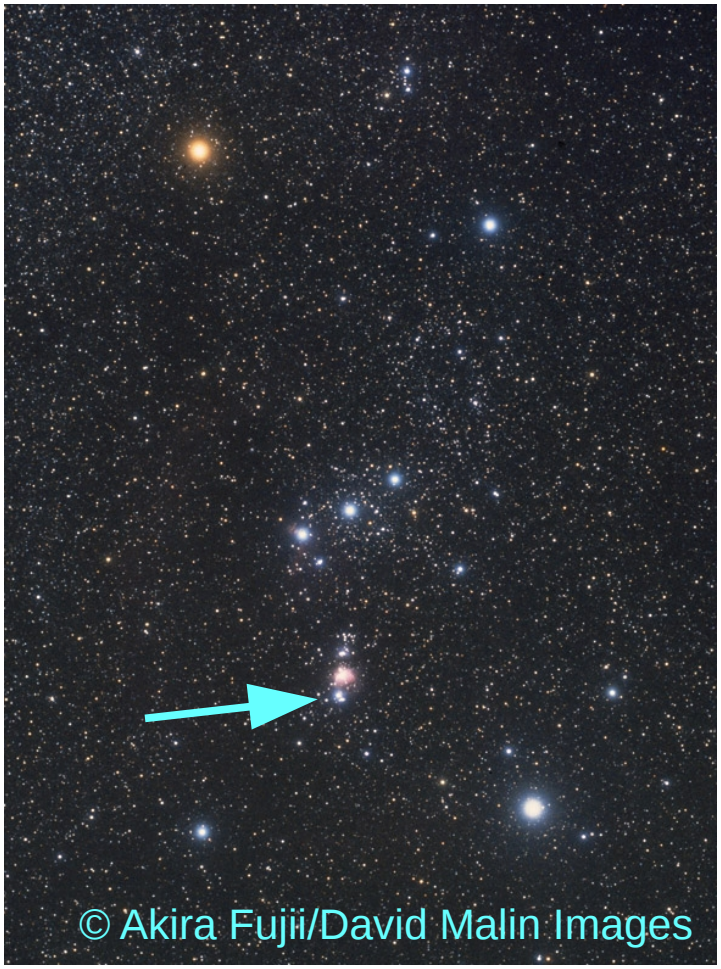
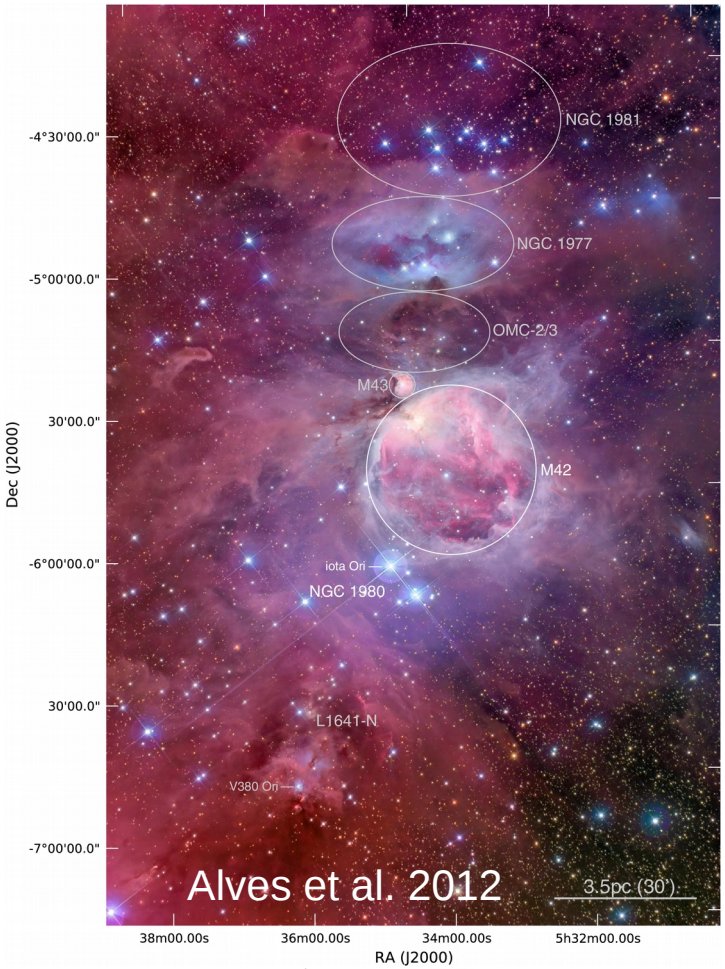
Iota Orionis

- Overview of the system
- Preliminary orbital results

Iota Orionis



Clustering of Young Stars



- Rich stellar population in front of Orion A cloud
  - spatial distribution
  - luminosity function
  - velocity dispersion
- Spatial distribution peaks strongly around NGC 1980 (iota Ori)
- Age ~ 4-5 Myr
- Distance ~ 300-320 pc
- Alves et al. 2012, Pillitteri et al. 2013

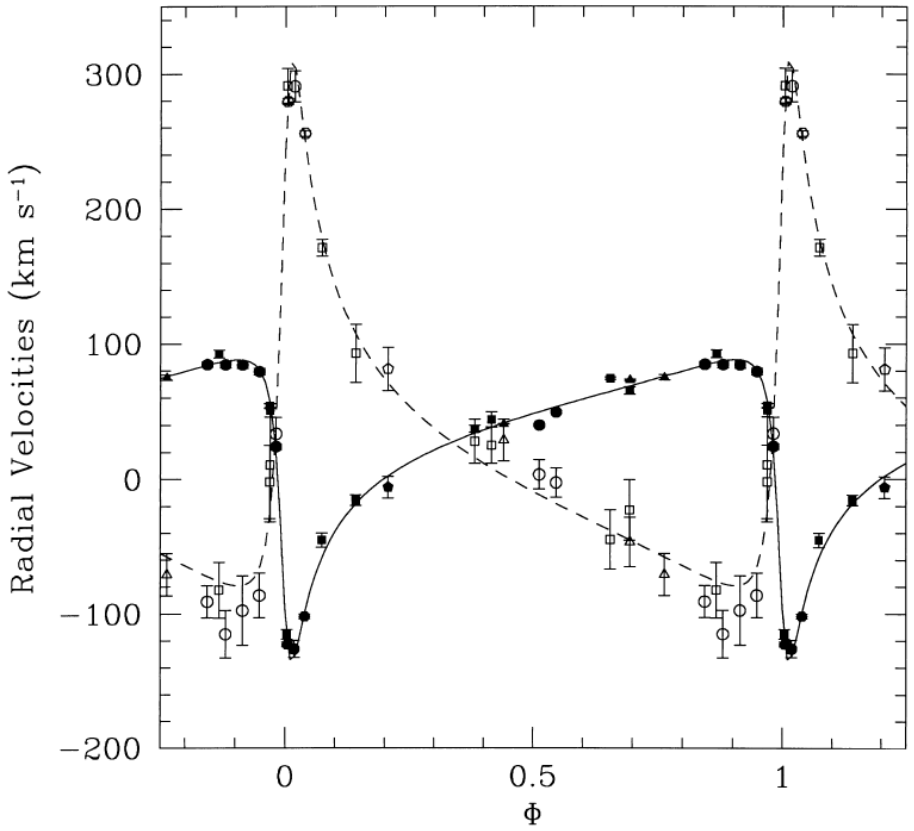
Iota Orionis - Binarity

- A,C: sep = 49 arcsec, Δmag = 7.0
- A,B: sep = 12 arcsec, Δmag = 5.0
- Aa,Ab: sep = 140 mas, Δmag = 3.3

(Washington Double Star Catalog)

- Spectroscopic Binary: Aa1,Aa2
  - O9 III + B1 III-IV
  - Orbital period: 29 days

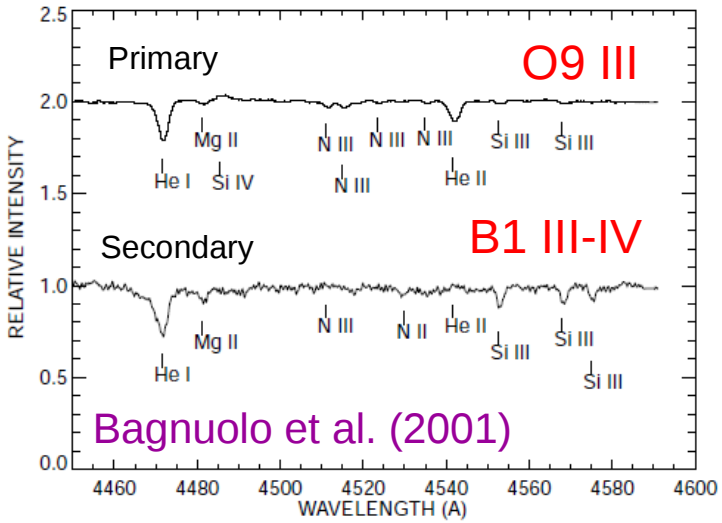
Iota Orionis Spectroscopic Orbit

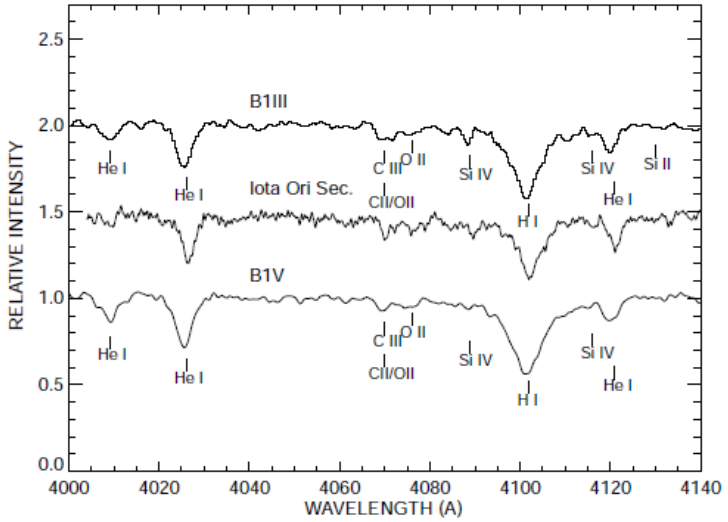


P = 29.13376 (fixed)
T = 24,511,121.685 ± 0.046
e = 0.764 ± 0.007
ω_A = 130.0° ± 2.1°
K_A = 111.9 ± 2.5 km/s
K_B = 195.7 ± 4.3 km/s
q = 0.572

Marchenko et al. (2000)

Evidence for a Capture Origin Binary?

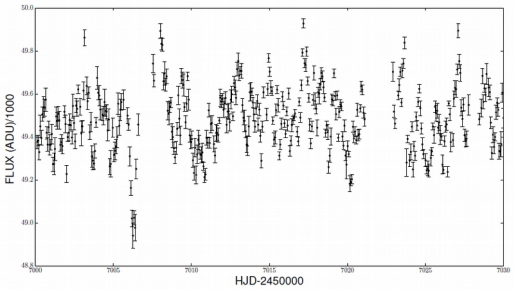


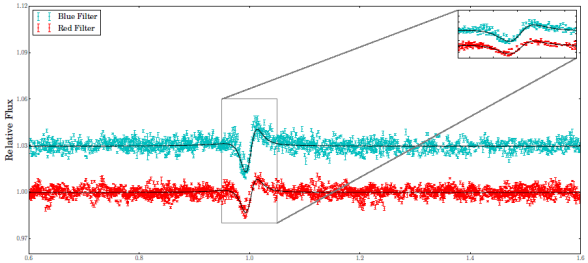


- Different ages for primary and secondary components
- No evidence that binary undergone significant mass transfer
- Possible origin: survivor of binary-binary encounter that led to ejection of runaway stars AE Aur and μ Col (Bagnuolo et al. 2001)
- Dynamical simulations: Gualandris et al. (2004)

Heartbeat Star: Tidal Distortions

- Tidal distortion – presence of heartbeat signal at periastron
- Tidally induced oscillations
- Combine spectroscopic and light curve analysis (BRITE):
  - $M_1 = 23.18 \pm 0.57\ M_\odot$
  - $M_2 = 13.44 \pm 0.30\ M_\odot$
  - $R_1 = 9.10 \pm 0.12\ R_\odot$
  - $R_2 = 4.95 \pm 0.23\ R_\odot$



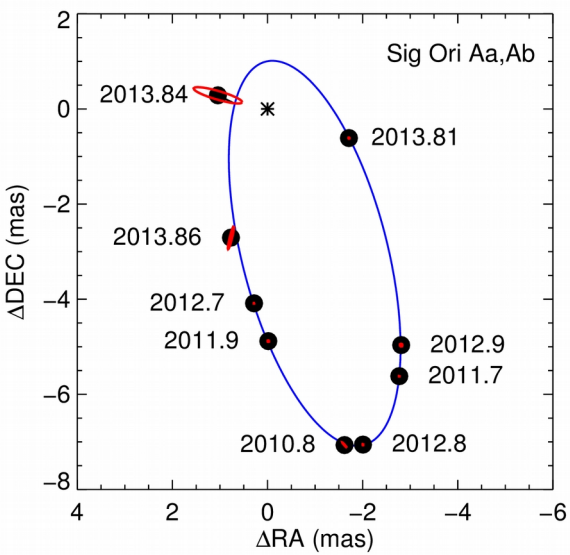


Pablo et al. (2017)

MIRC Observations of Iota Ori

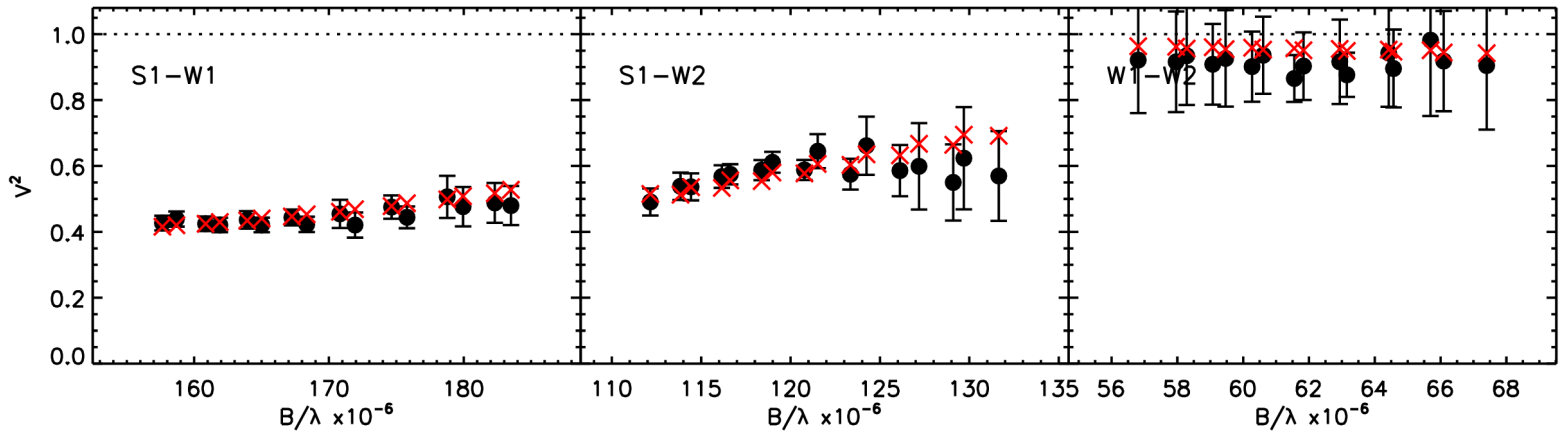
- Originally observed in same program as the O-star triple sigma Orionis

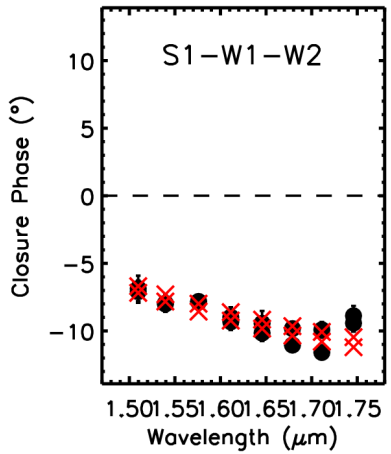
- Iota Orionis Observations
  - UT 2008 Dec 02 – S1E1W1W2
  - UT 2010 Nov 05 – S1W1W2
  - UT 2011 Dec 09 – S1S2E2W2
  - UT 2016 Nov 18 – S1E2W1W2

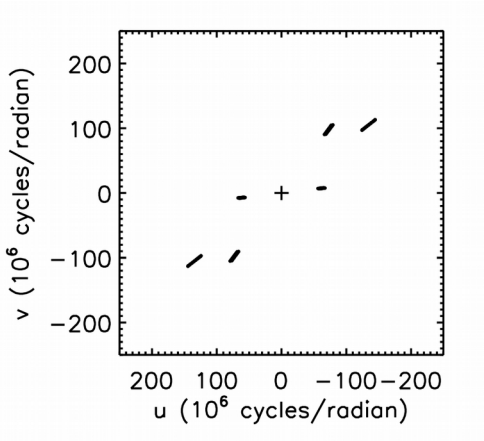


Sigma Orionis
Schaefer et al. (2016)

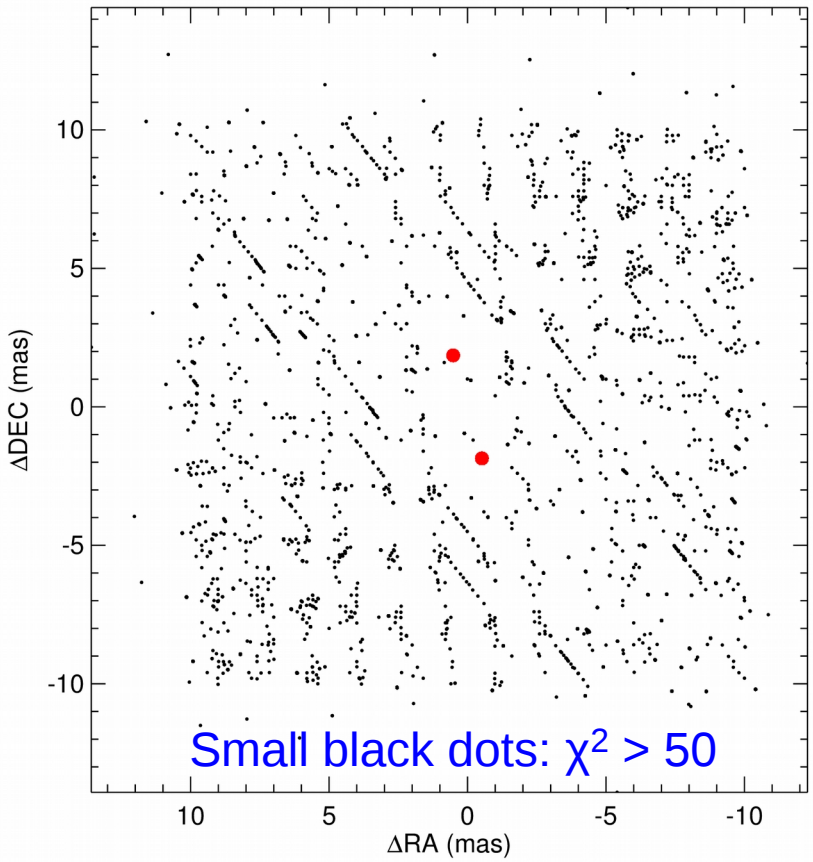
MIRC Data – UT 2010 Nov 5







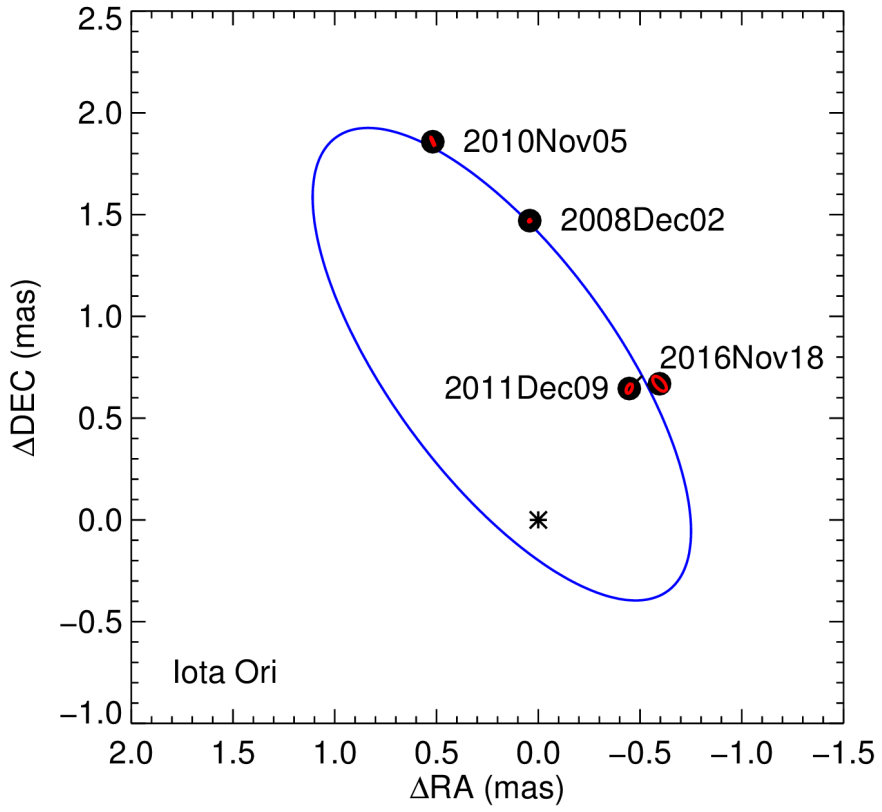
Adaptive Grid Search Procedure

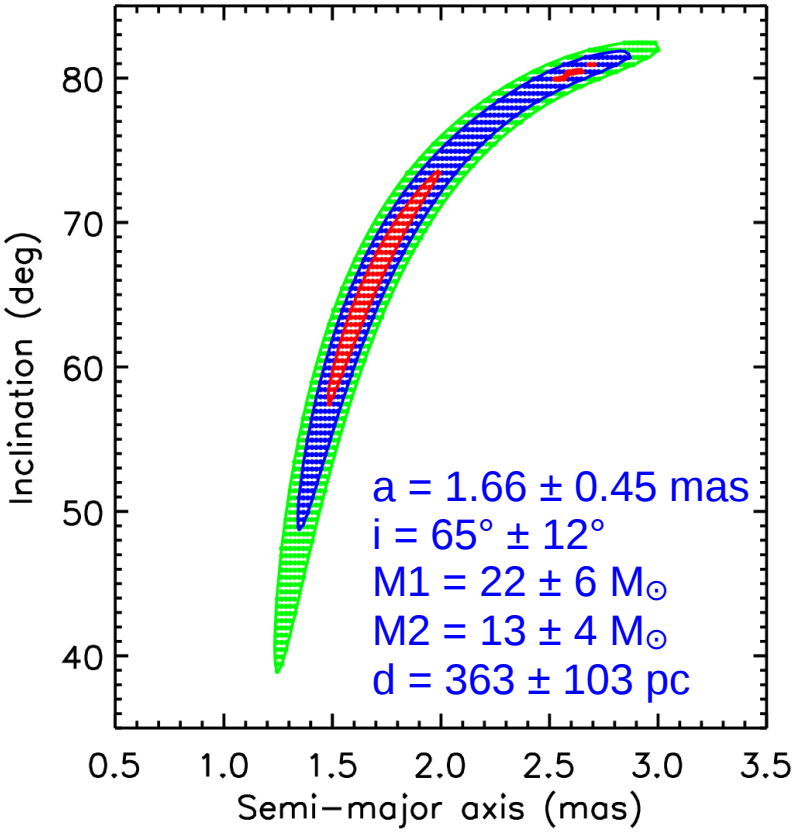


ρ = 1.93 ± 0.02 mas
PA = 15.6° ± 0.3°
Flux ratio = 0.229 ± 0.001

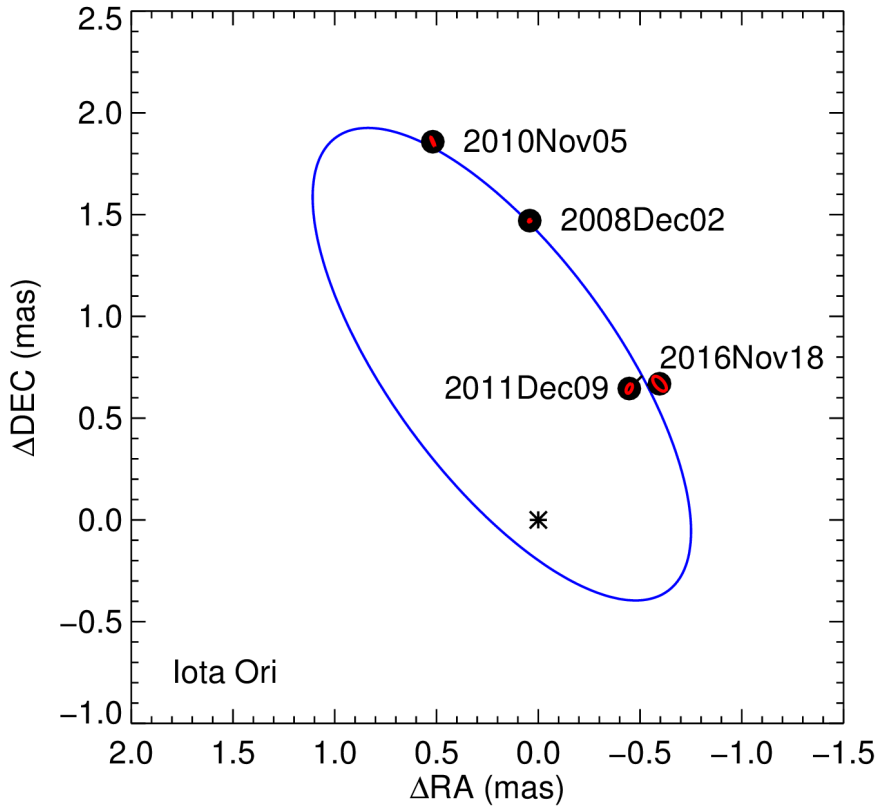
Similar in approach to CANDID binary fitting code (Gallenne et al. 2015)

Preliminary Results





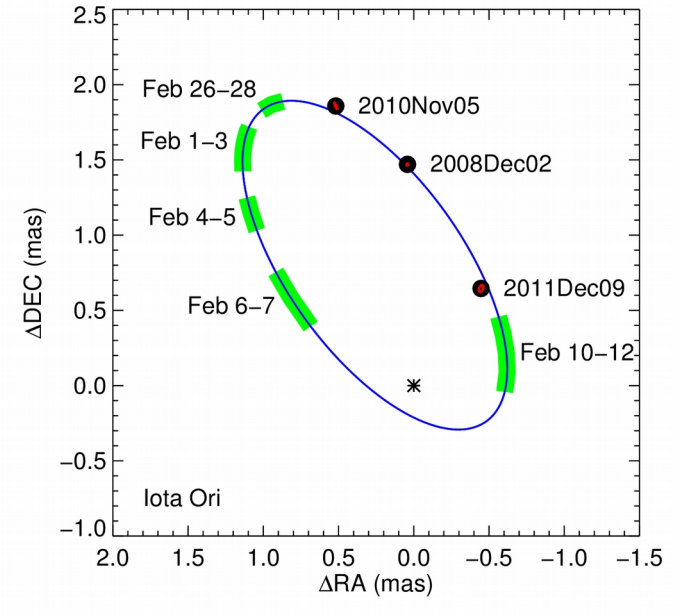
Preliminary Results



Pablo et al. (2013):
i = 62.86° ± 0.17°
M1 = 22.2 ± 0.6 $M_\odot$
M2 = 13.4 ± 0.3 $M_\odot$

CHARA Results:
a = 1.66 ± 0.45 mas
i = 65° ± 12°
M1 = 22 ± 6 $M_\odot$
M2 = 13 ± 4 $M_\odot$
d = 363 ± 103 pc

Observations - 2017A



- Weathered out on 2017 Feb 3, 5, 7, 10
- UT 2017 Feb 09 – S1S2W2
  - not sufficient for reliable measurement

Looking Ahead to 2017B

- Propose to complete orbit in 2017B
- Independent measurement of dynamical masses and orbital parallax
- Confirmation of astroseismic results (Pablo et al. 2017)
- Further test of binary-binary collision