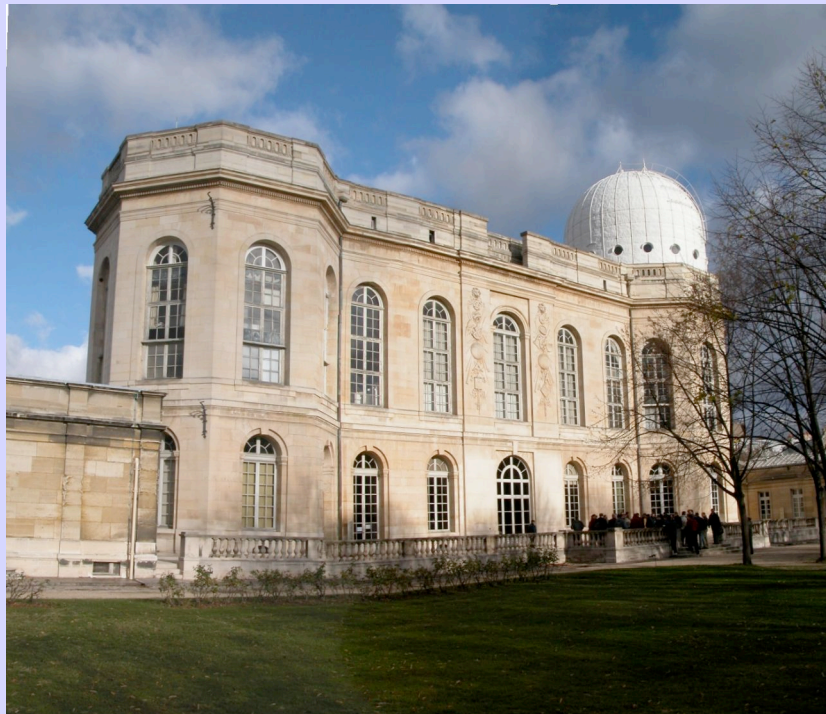


ABOUT RELATIVISTIC CLOSE APPROCHES BETWEEN JUPITER AND QUASARS IN THE PERSPECTIVE OF THE GAIA MISSION

Jean Souchay & Christophe Leponcin-Lafitte
Observatoire de Paris







About Relativistic Close Approaches between Jupiter and Quasars in the perspective of the GAIA Mission

- I. Introduction
- II. Present quasar catalogs and the ICRF
- III. The GAIA space mission
- IV. Close approaches between Jupiter and Quasars
- V. Conclusion

I. INTRODUCTION

Why to study close approaches between Jupiter and Quasars ?

-  Link between the ICRS (International Celestial Reference System) and the Dynamical System
-  Checking validities of planetary and satellite ephemerides
-  Studying the differential observations between GAIA and the Earth
-  Modelizing and observing the relativistic effect of deviation of light due to J2 of Jupiter

II. PRESENT QUASAR CATALOGS & THE ICRF

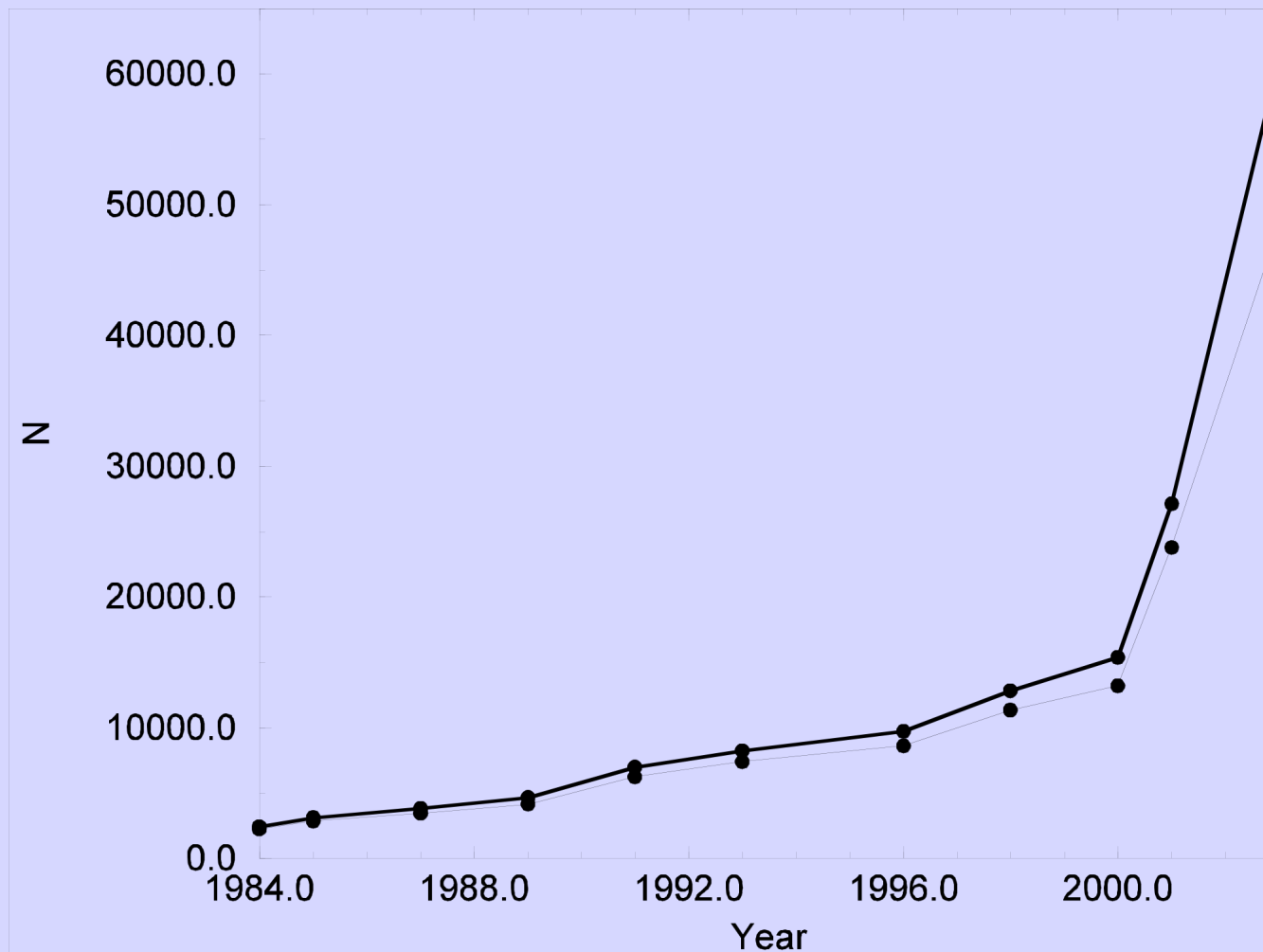
PRESENT QUASAR CATALOGS & THE ICRF

- CDS => 131 entries
- Most complete optical catalog : Veron-Cetty & Veron ([A&A,2006](#))
 - 85 221 quasars
 - 1 122 BL Lac objects
 - 21 737 Active Galactic Nuclei
- Specific study with Veron-Cetty & Veron ([A&A,2003](#))

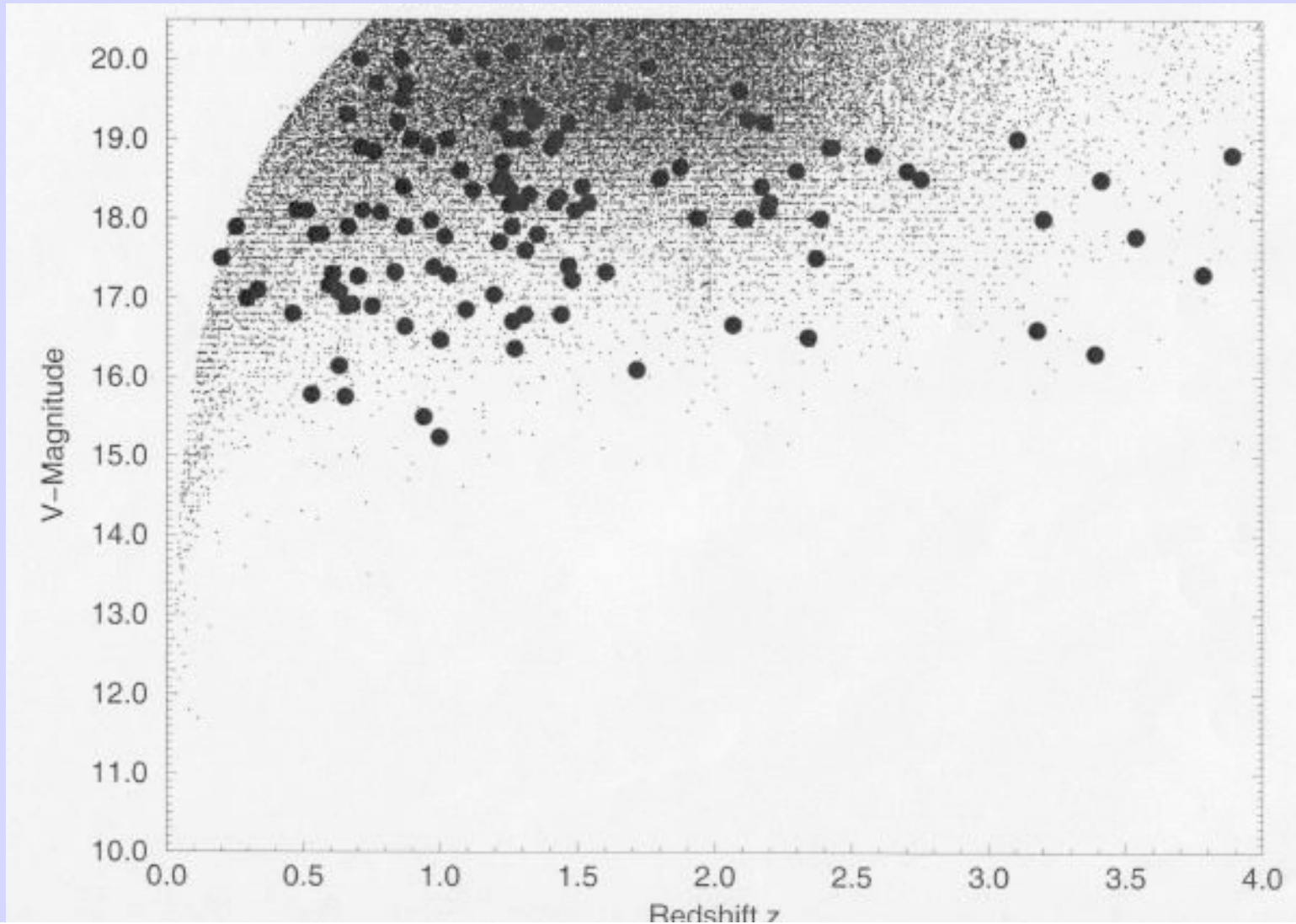
« Cross identifications and asto-photometric comparisons of the UCRF with recent catalogs of quasars » ([Souchay J., Gontier A.M., Barache,C., A&A, in press](#))

Number of recorded quasars

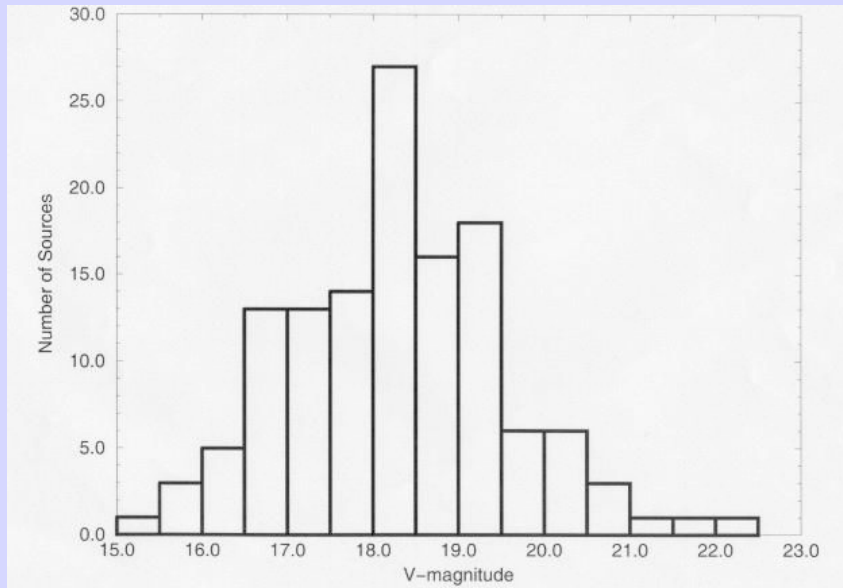
(Veron-Cetty and Veron)



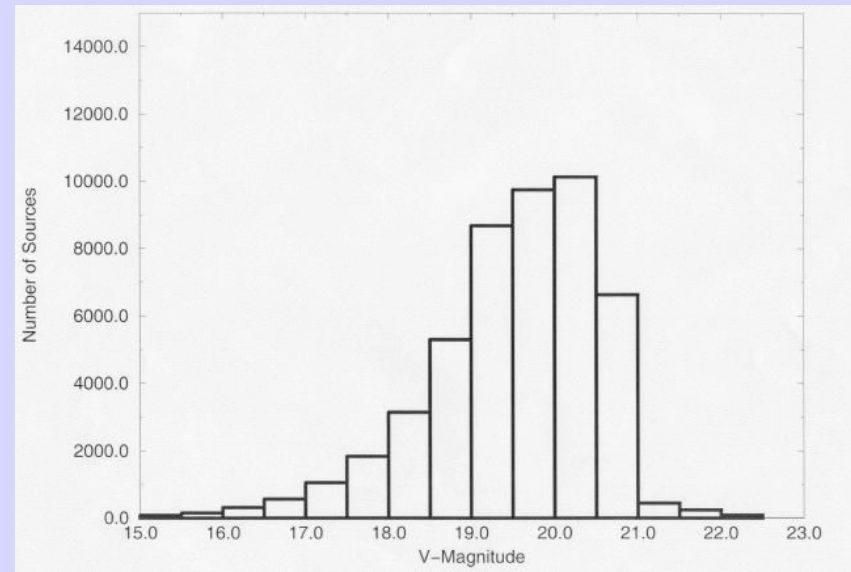
V- Magnitude vs. Redshift



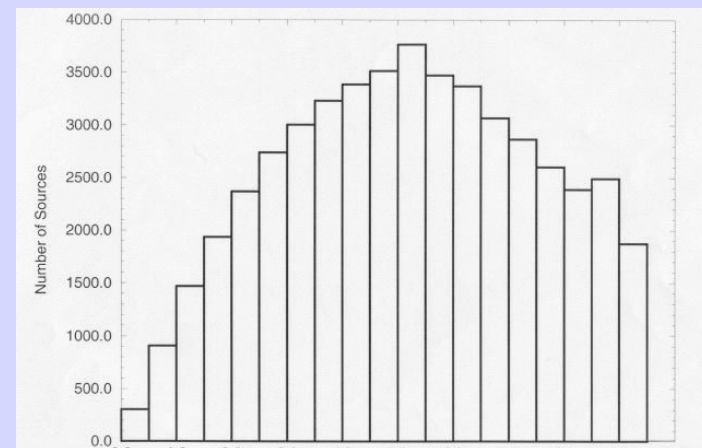
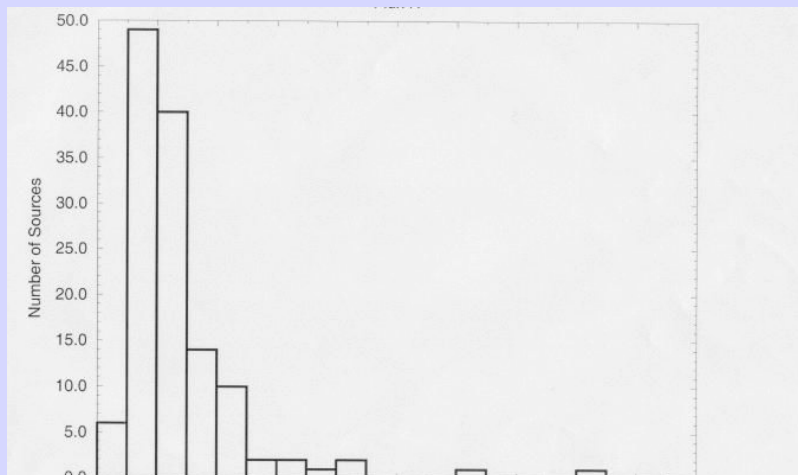
Photometric & radio-flux comparisons



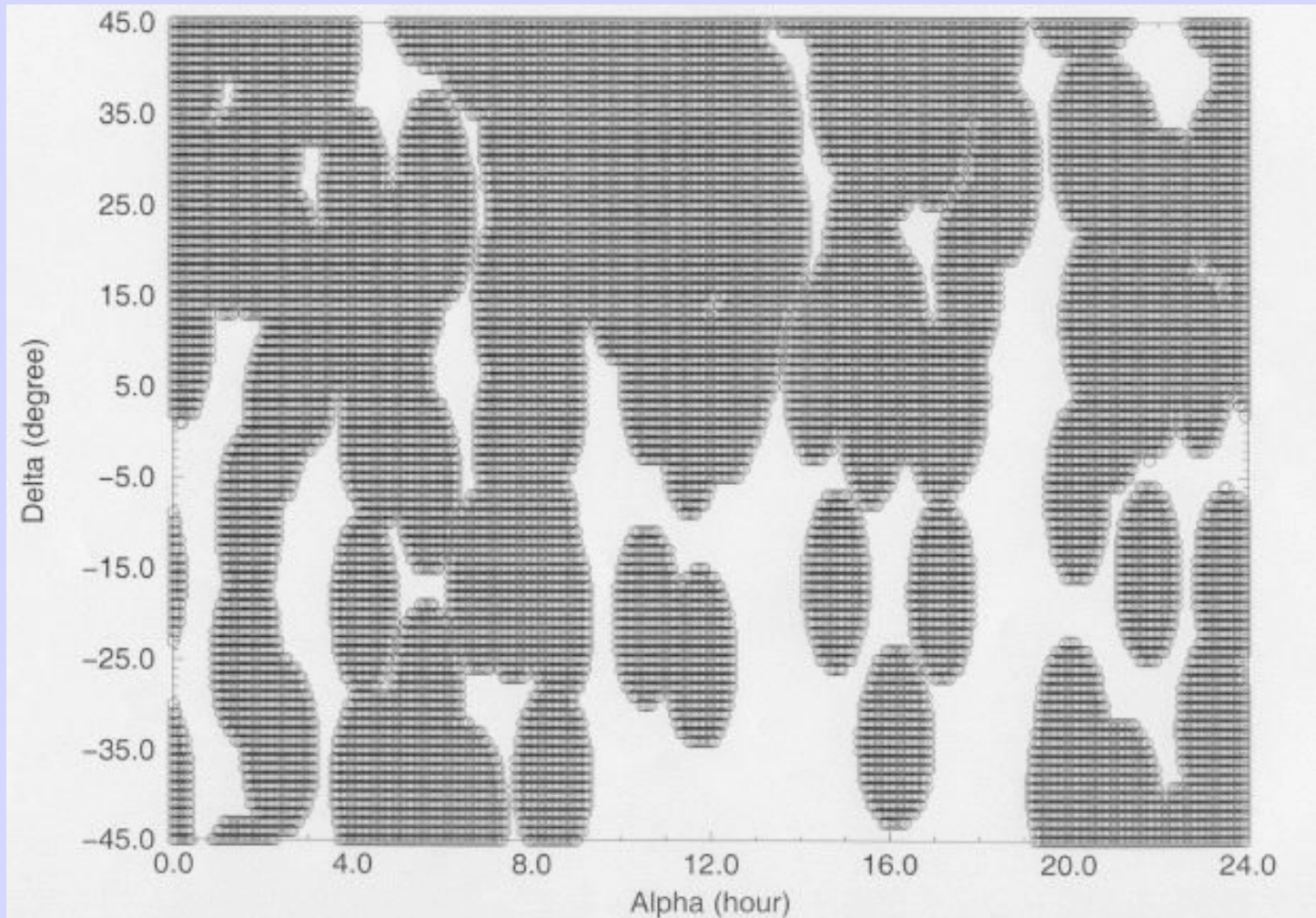
ICRF



VV2003



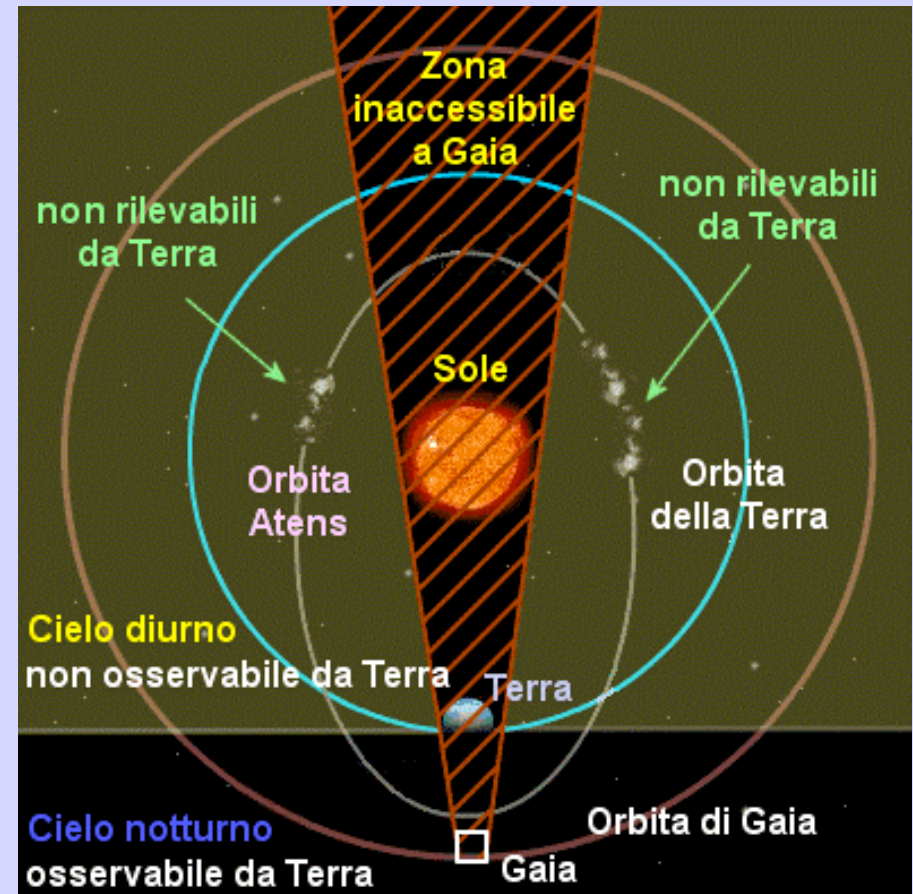
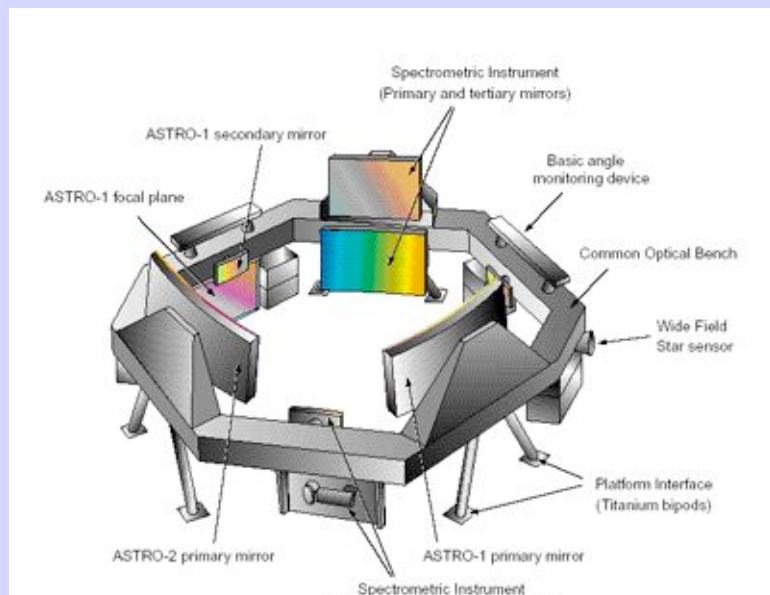
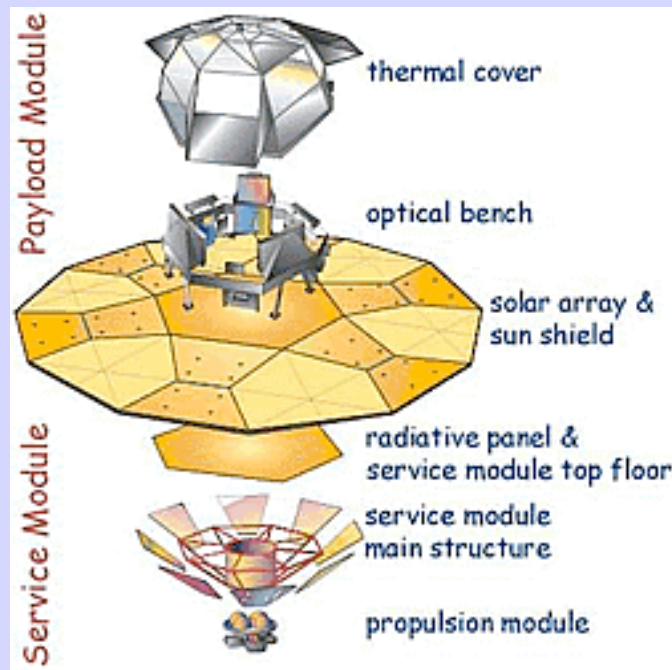
Sky coverage (ICRF)



10° threshold

III. The GAIA space mission

The GAIA space mission



The GAIA space mission

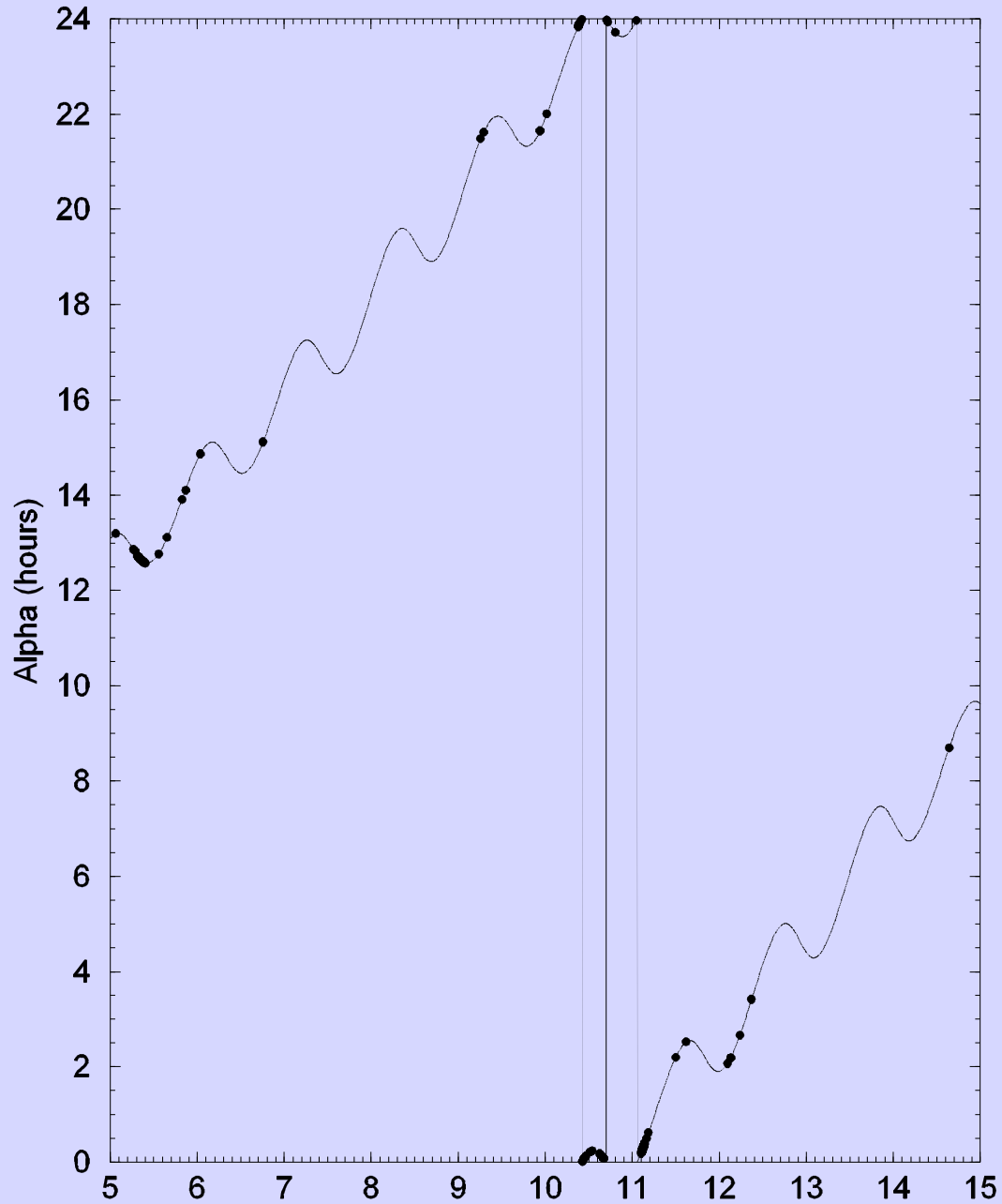


- Launching ~2010
- L2 Sun-Earth
- $\sim 10^9$ stars, completeness $m=20$
- photometry + radial velocities
- $4 \mu\text{as}$ at $V=12$, $150 \mu\text{as}$ at $V=20$
- About 500 000 QSO'S

***IV. CLOSE APPROACHES BETWEEN
JUPITER & QUASARS***

coordinate Alpha

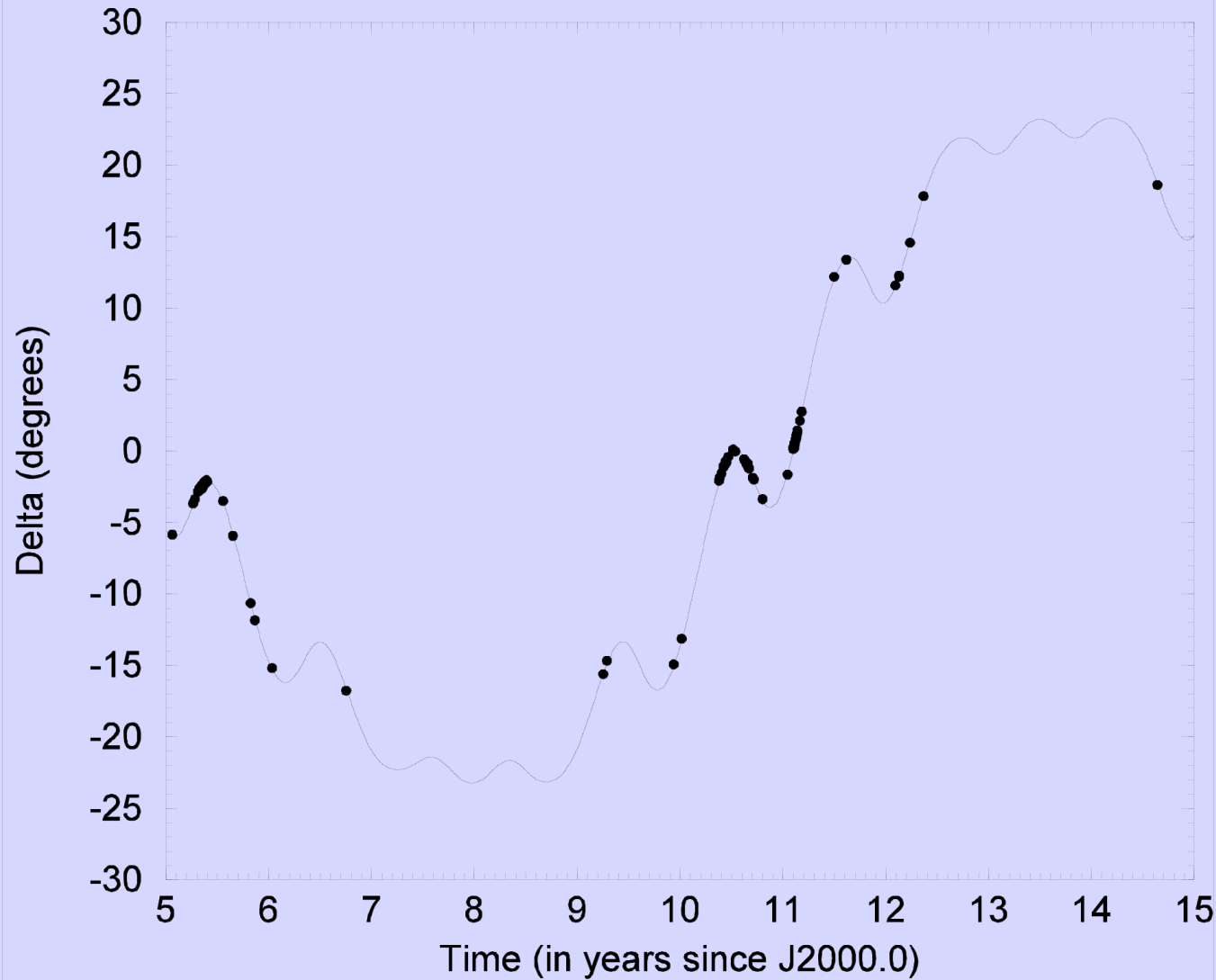
Jupiter vs. quasars



α coordinates for
Jupiter and
encountering
quasars
(2005-2015)

coordinate Delta

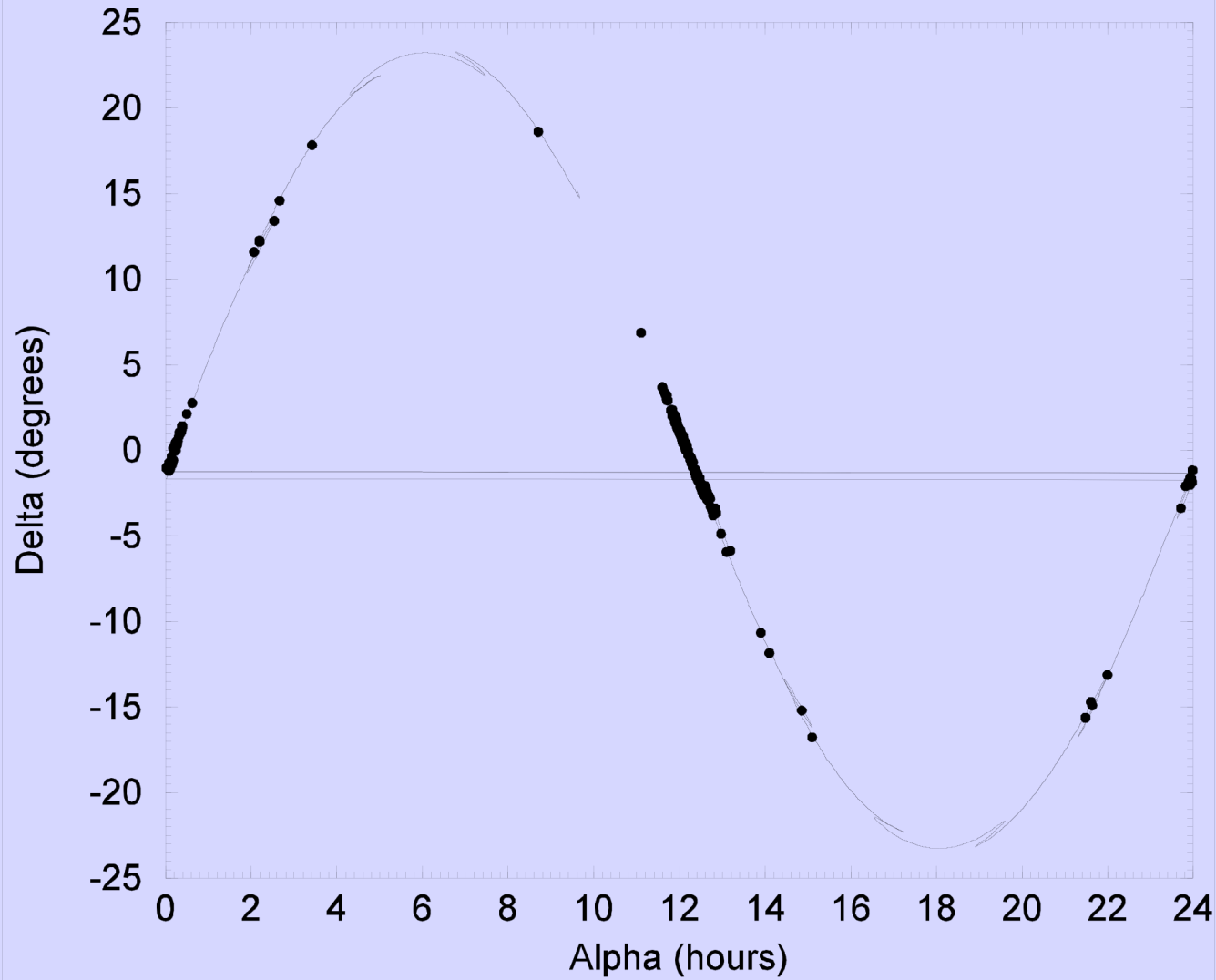
Jupiter vs. quasars



δ coordinates for
Jupiter and
encountering
quasars
(2005-2015)

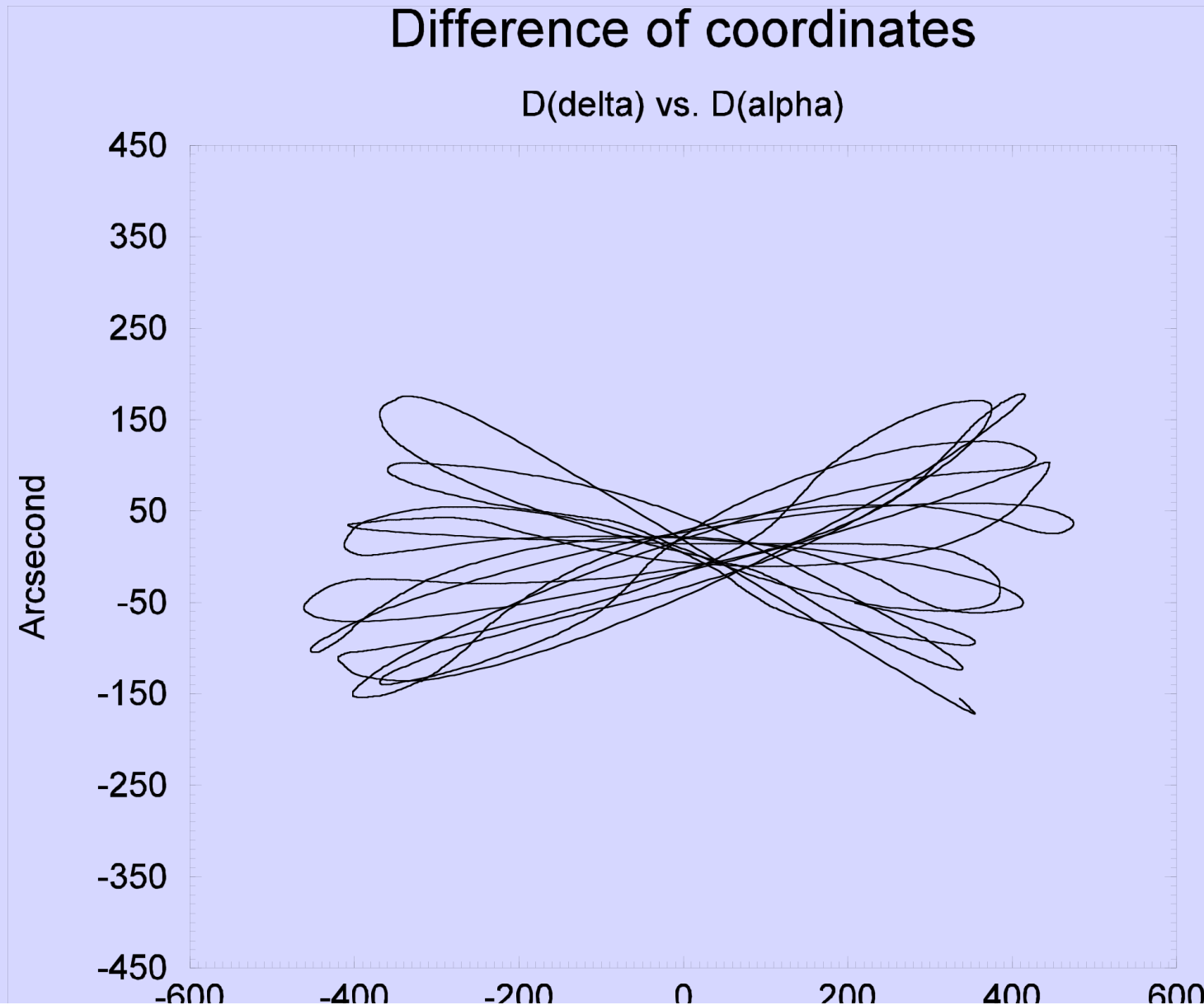
coordinate Delta vs. Alpha

Jupiter vs. quasars

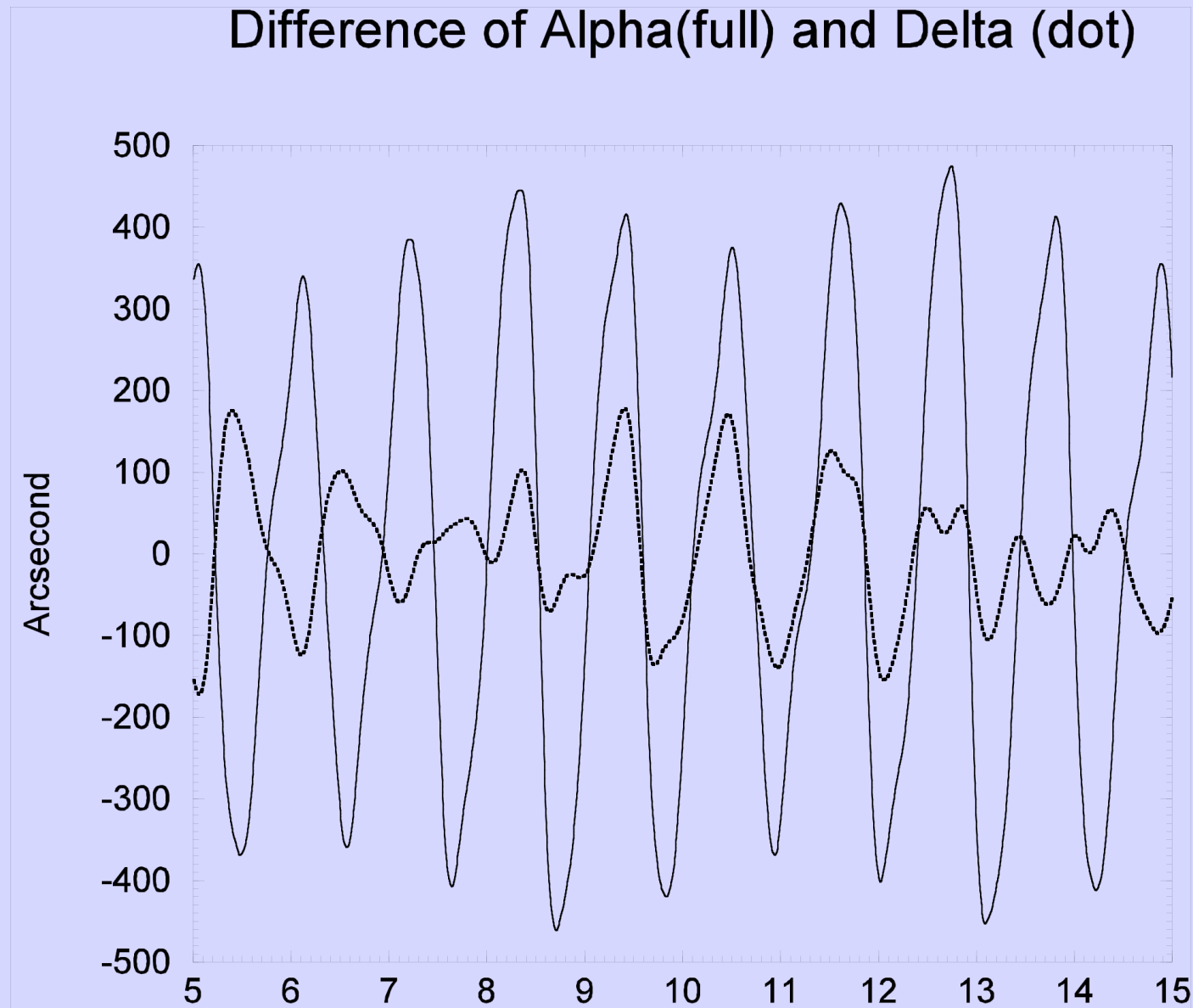


δ vs. α coordinates
for Jupiter and
encountering
quasars
(2005-2015)

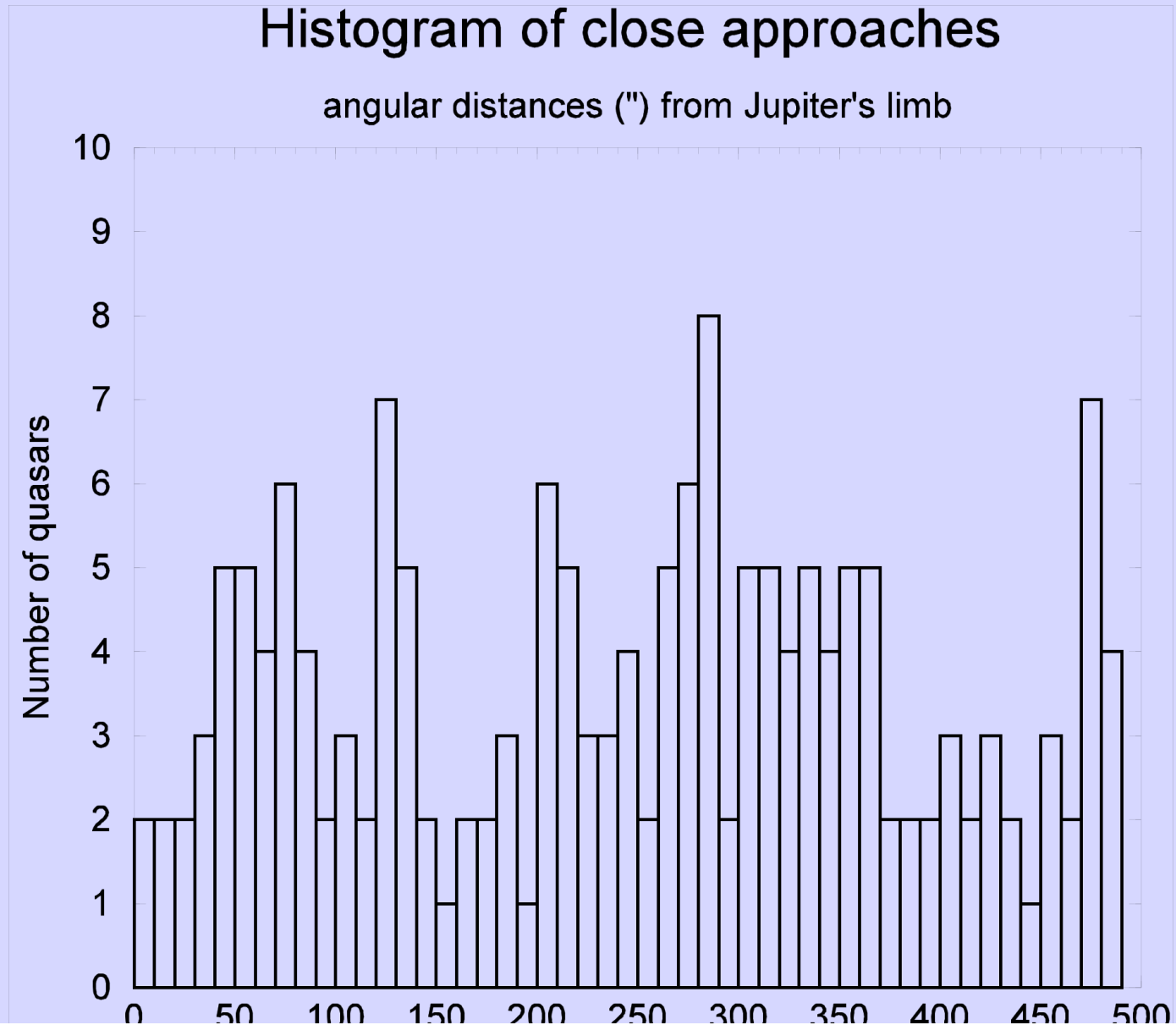
δ vs. α Jupiter coordinate differences between Earth ground observer and GAIA (2005-2015)



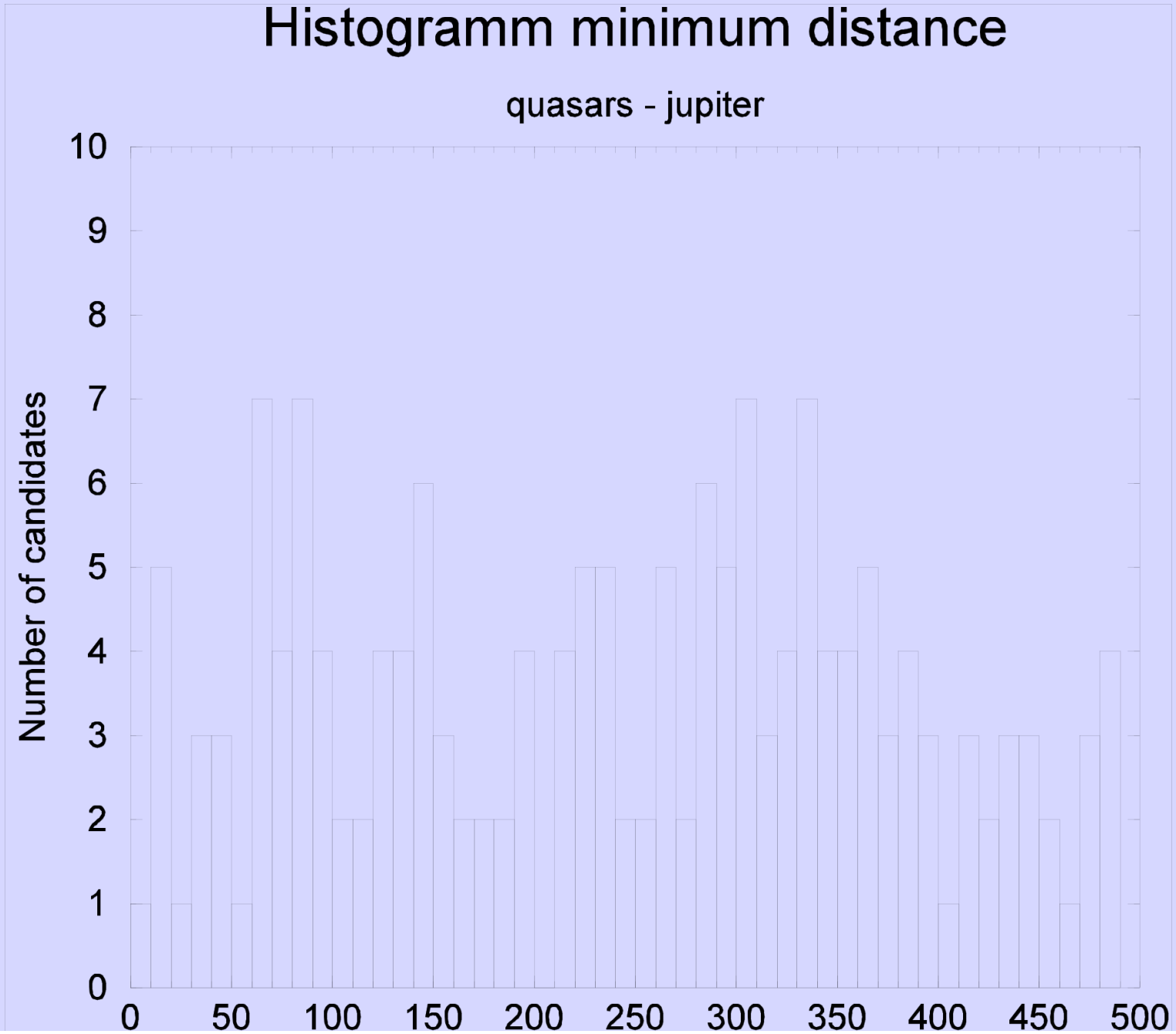
α and δ Jupiter coordinate differences between Earth ground observer and GAIA (2005-2015)



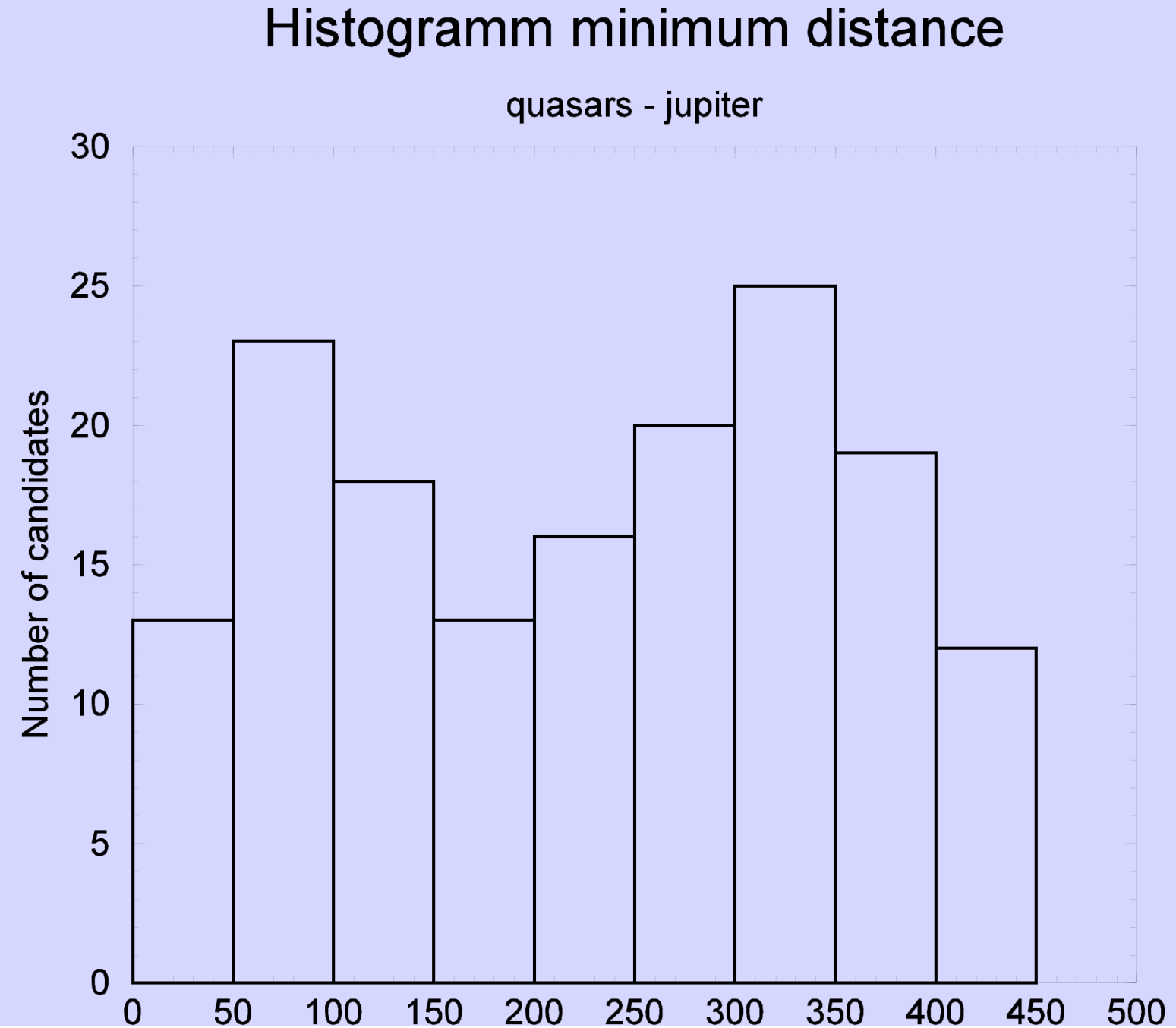
Close approaches Jupiter-quasars (2005-2010)



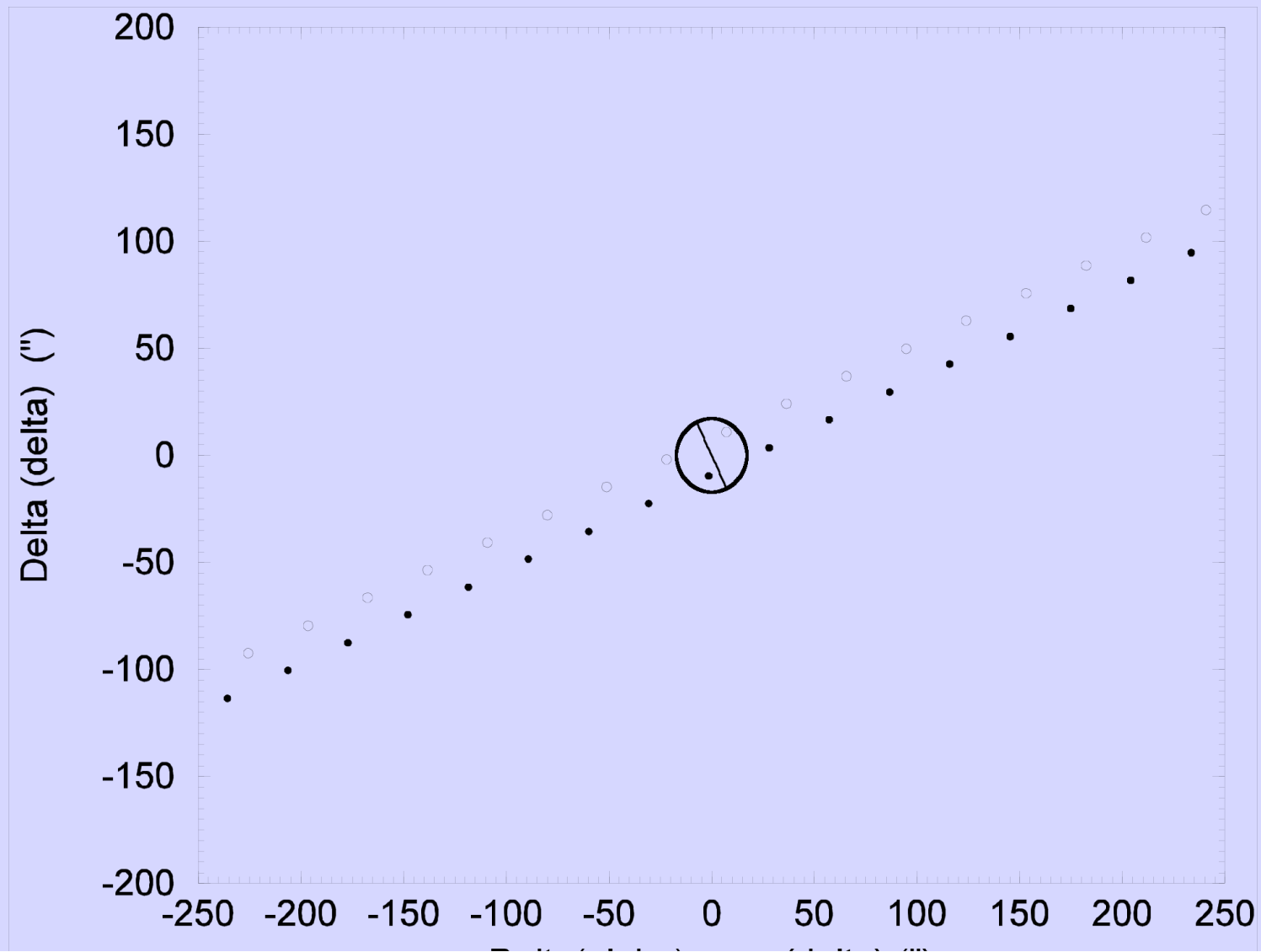
Close approaches Jupiter-quasars (2005-2010)



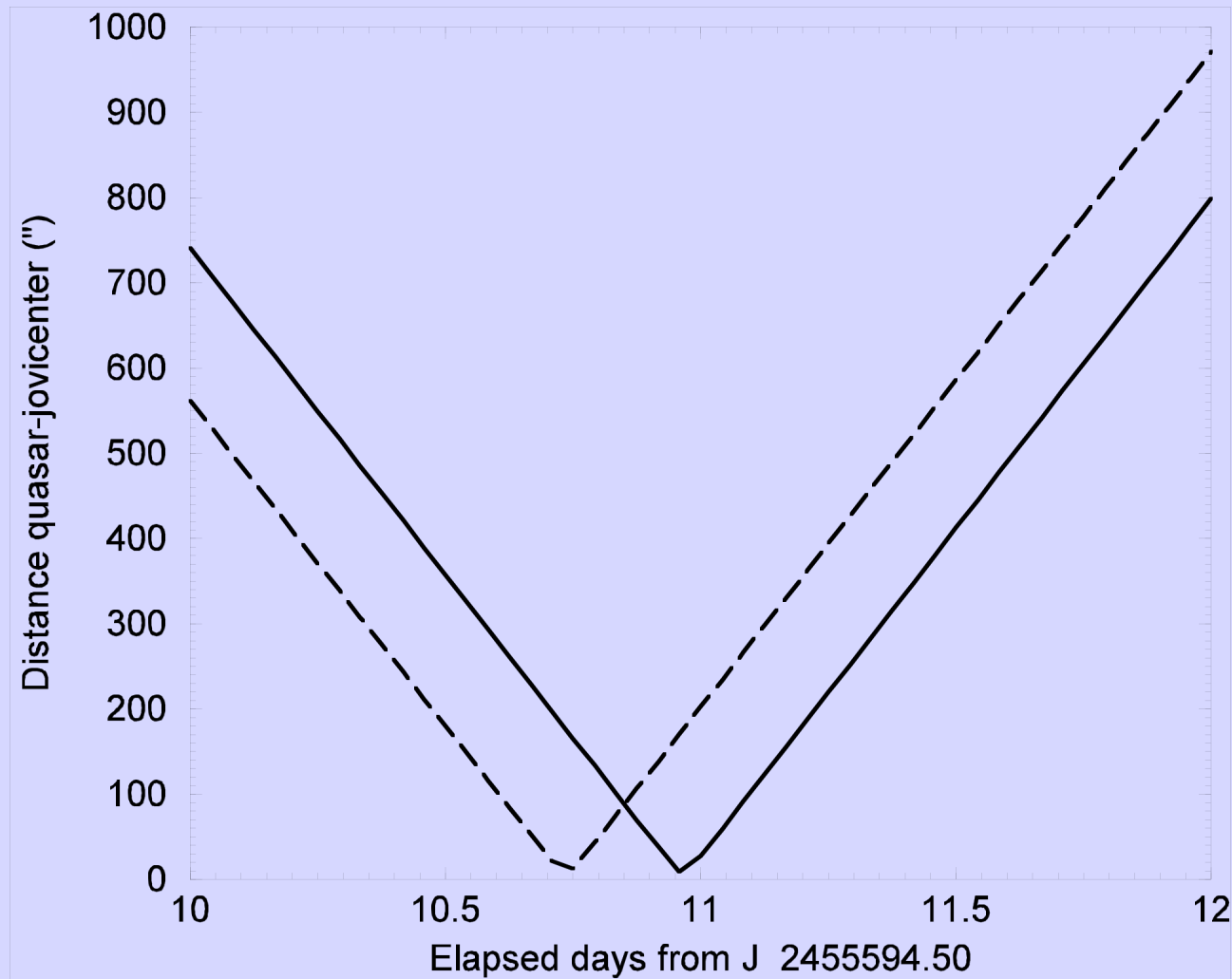
Close approaches Jupiter-quasars (2005-2015)



Angular distance quasar-jovicenter



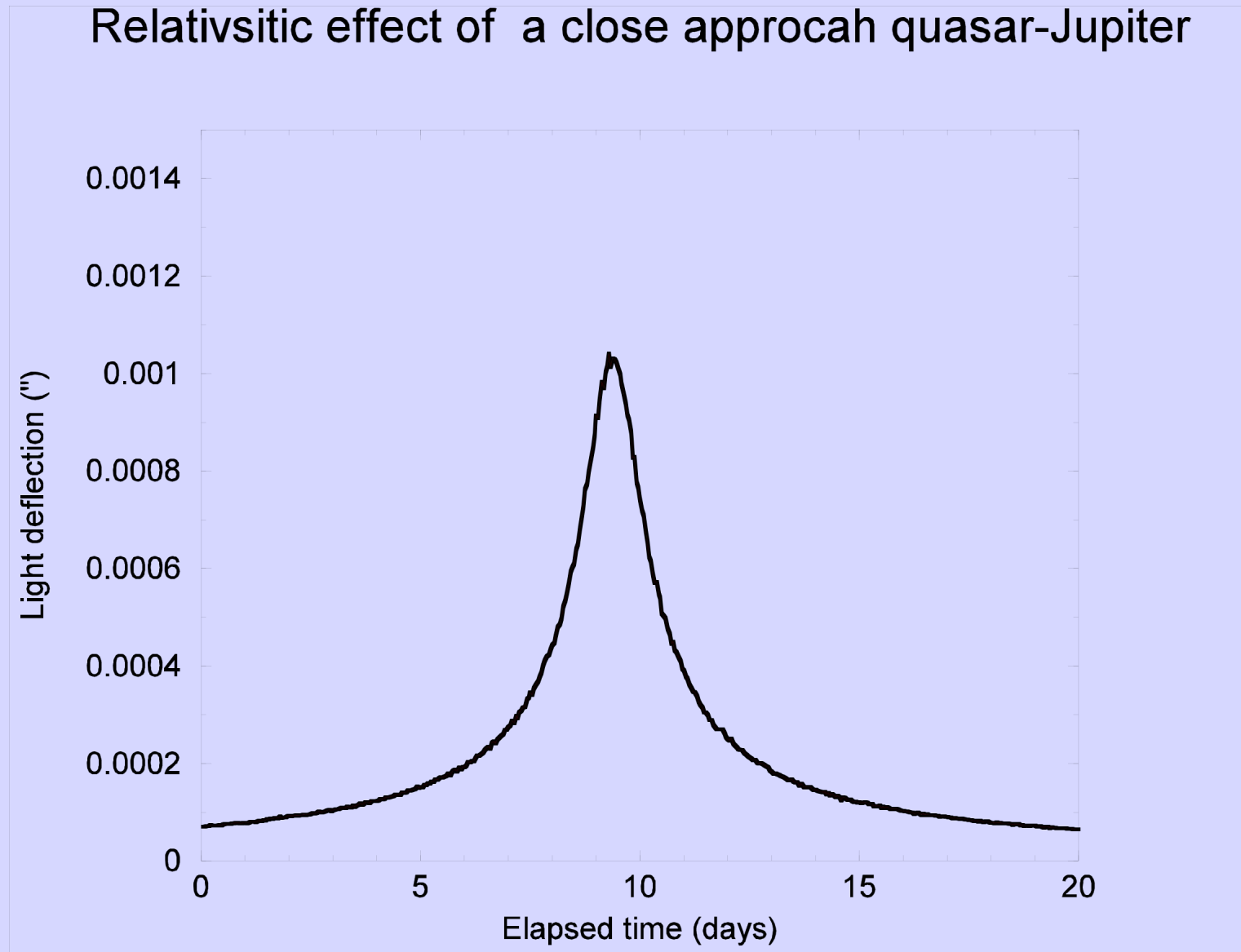
Angular distance quasar-jovicenter



Law of Light Deflection

$$\lambda = (\gamma + 1) \times \frac{GM}{c^2 r_c} \times \mathbf{n}_B - \mathbf{N} / \operatorname{tg}(\alpha / 2)$$

Relativistic deflection of light



Statistics of close approaches Jupiter-quasars

Between 2010 and 2015

24 close approaches $< 300''$

9 close approaches $< 100''$

=> evaluation of ang. distances

=> astrometry and photometry

V. CONCLUSION