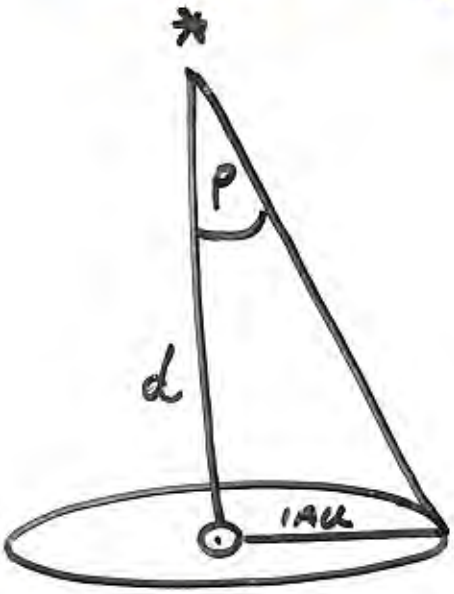
PARALLAX DISTANCE MEASURE

- geometry
- know 1 AU, use Triangle of star, Sun, Earth



$$\tan p = \frac{1\ AU}{d}$$

If p small, use Taylor series

$$f(0+\varepsilon) \cong f(0) + \varepsilon f'(0)$$

$$\tan(p) \cong \tan(0) + p \left.\frac{d}{d\theta}(\tan\theta)\right|_0$$

$$= 0 + p \cdot \sec^2 0 = p \quad \text{(in radians)}$$

So p (in radians) $= \frac{1\,AU}{d}$

$$d \text{ (in AU)} = 2.06 \times 10^5 / p \text{ (in arcsec)}$$

Define a parsec (pc)

distance of a star with parallax of 1"

$$d \text{ (in pc)} = 1 / p \text{ (in arcsec)}$$

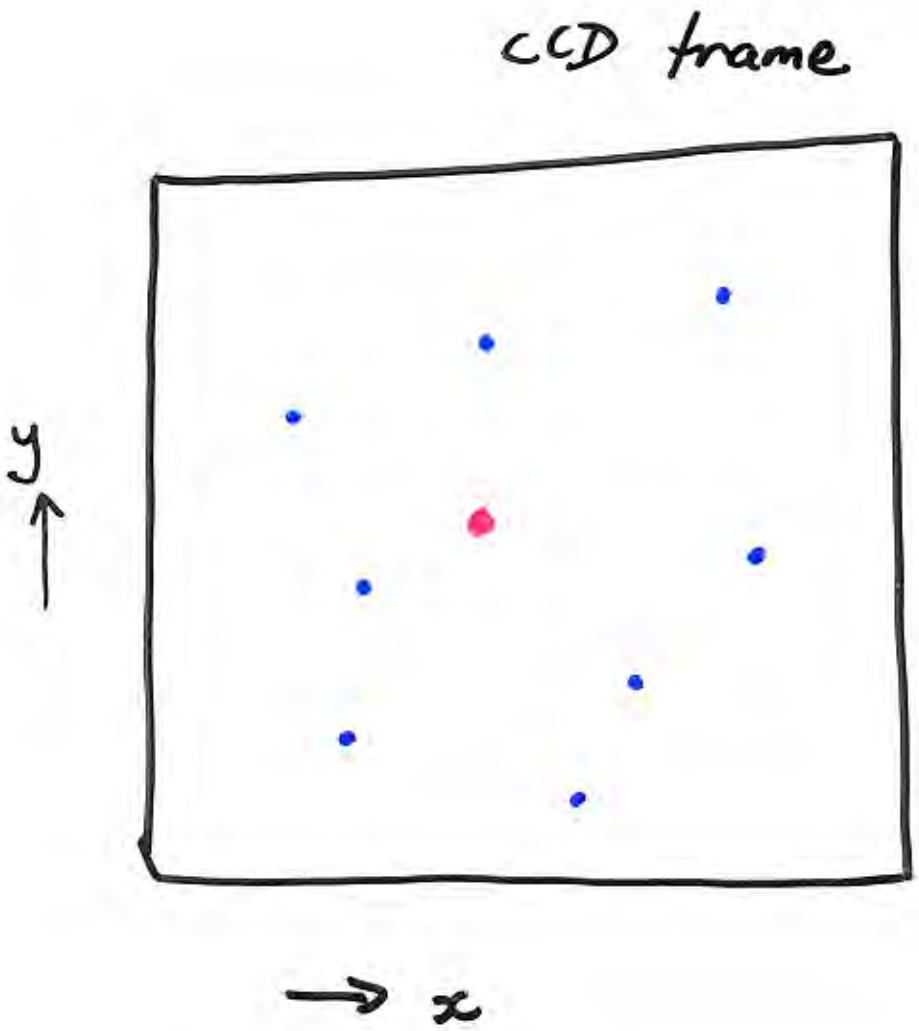
1 pc = 3.26 light years

kpc	10^3 pc	Galaxy distances
Mpc	10^6 pc	extragalactic distances

* A parsec is merely a convenient length measure

$1 pc = 3.09 \times 10^{18}$ cm

Data from Dr Conard Dahn (US Naval Obs Flagstaff AZ)

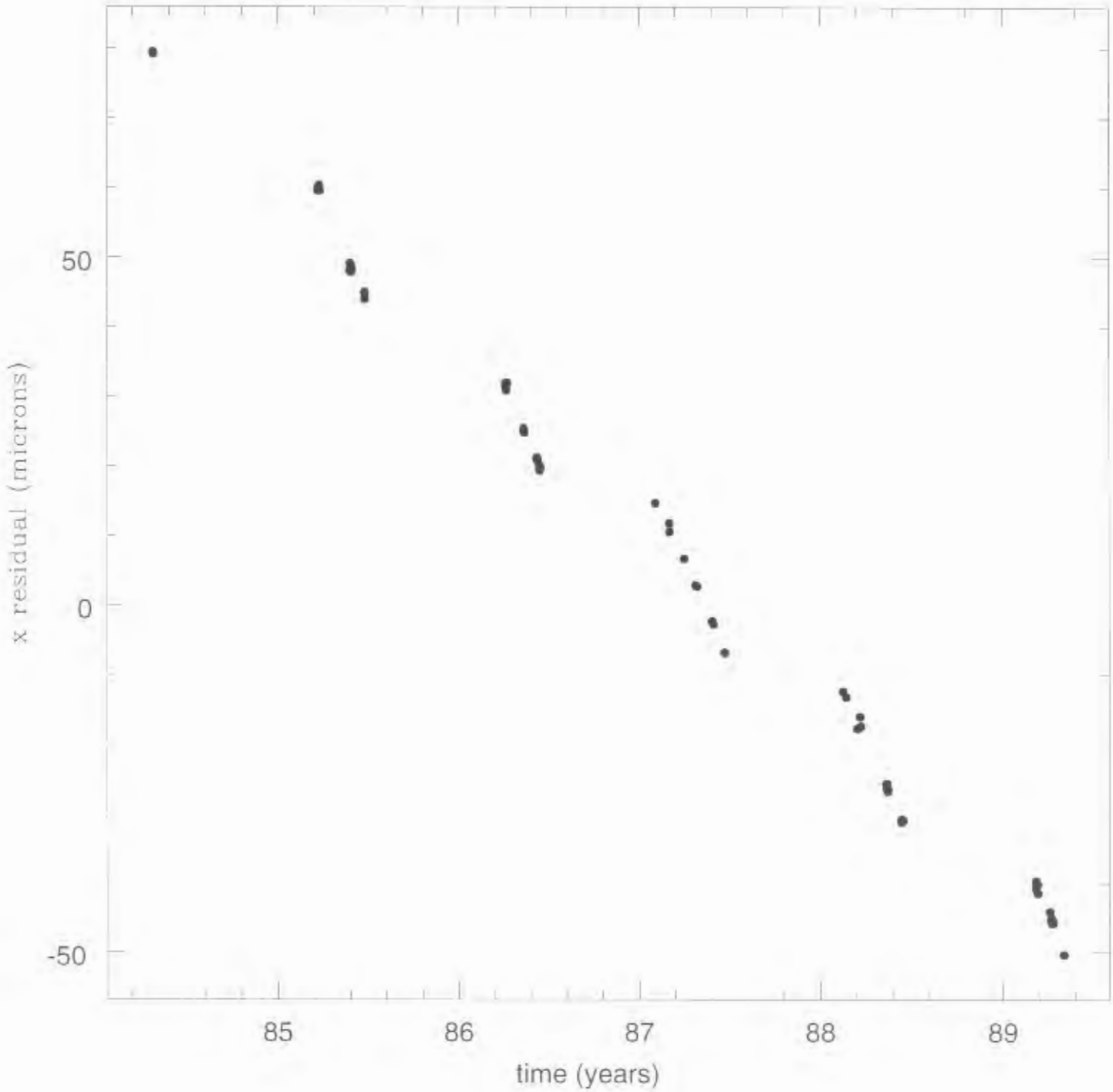


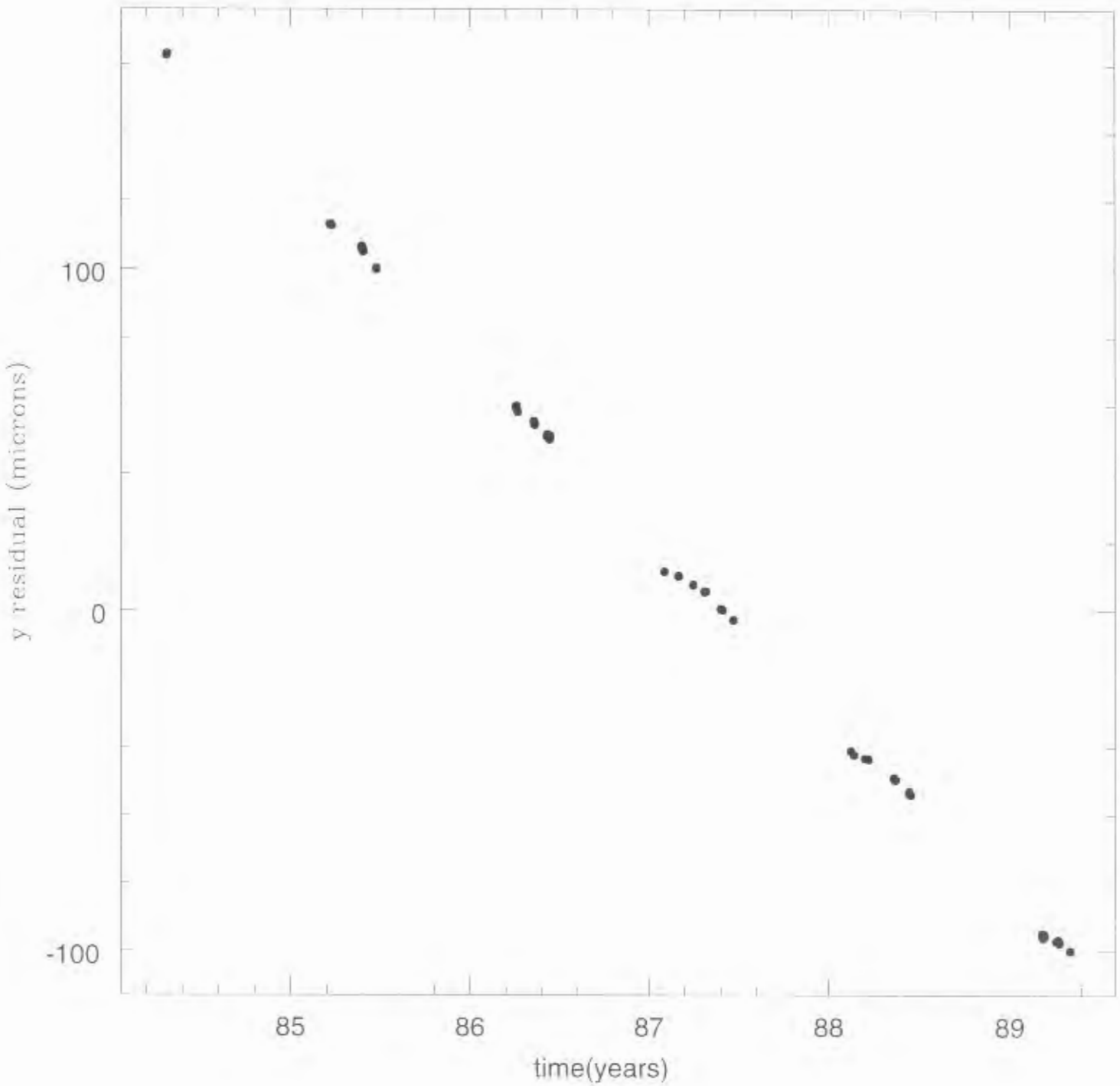
- parallax star (LHS 2924)
- reference stars

(10) The plots show the position of the star w.r.t. the reference stars, as a function of time, in x & y on CCD.

What is the star's proper motion in arcsec/year ?

(telescope scale is 74 microns per arcsec with this detector)


50
0
-50
x residual (microns)
85
86
87
88
89
time (years)

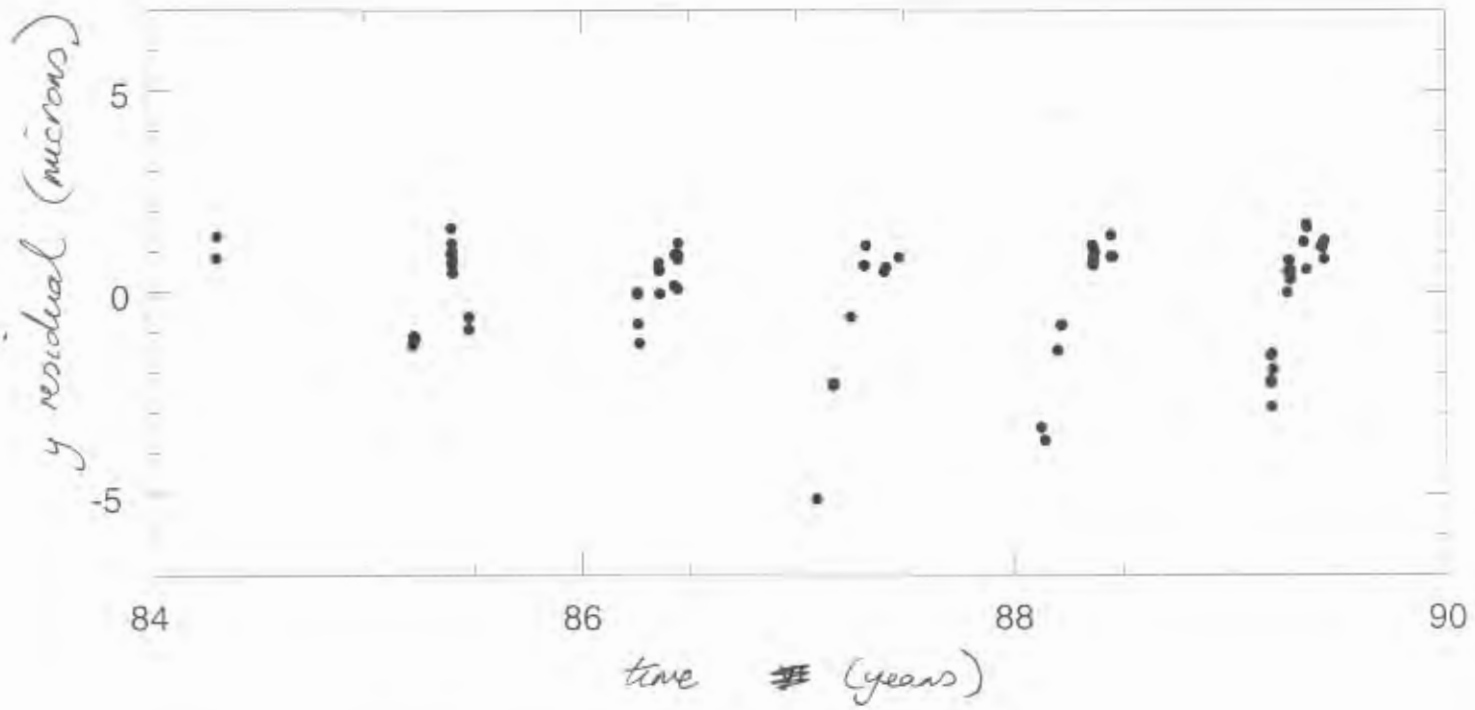

100
0
-100
y residual (microns)
85
86
87
88
89
time(years)

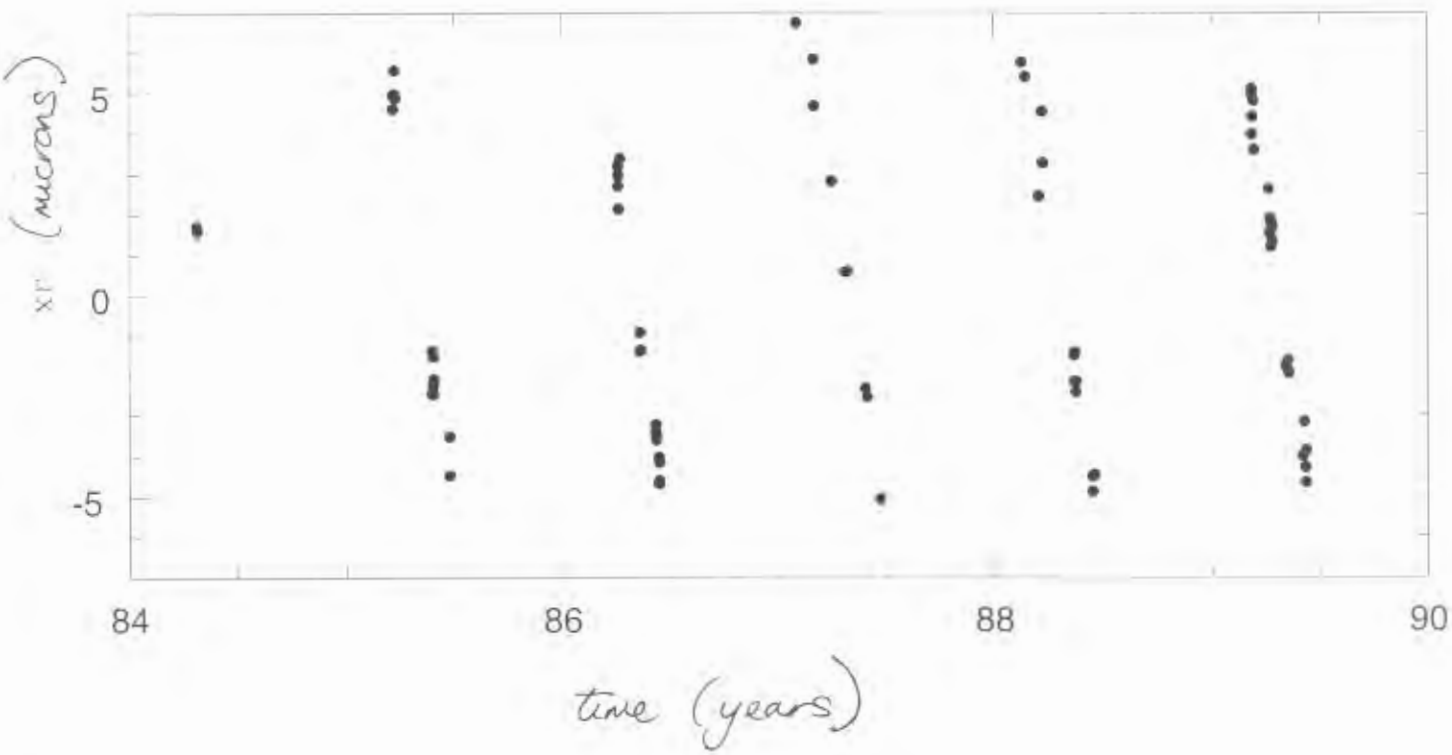
(c) The next 2 plots show the residual motion once proper motion is corrected for — due to the star's parallax.

What is the star's parallax ?

(express the parallax in arcsec, then derive the star's distance in parsecs)

Proper motion solved for and removed





(vi) The next 2 plots show x and y residuals once both proper motion and parallax motion are removed — what is left is due to measurement error.

Estimate the measurement error on the star's parallax and express the uncertainty in parsecs.

What are some likely sources of error?

Proper motion and parallax removed