Multiple Planets in Ref Stars

Size of Effect

- Jupiter-Sun @ 1Kpc ~5uas amplitude 12yr
- Most ref stars are 600pc~1Kpc
- NEAT wants 0.8uas accuracy at each epoch

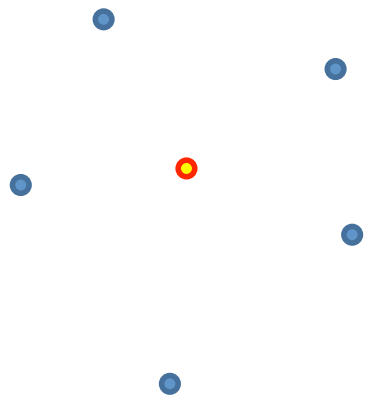
- We have to solve for planets around the ref stars down to ~1/10 Jupiter mass.
- Must also solve for relative parallax of each ref star. (and proper motion)

Solving for Ref Star Parameters

- GAIA uses its wide angle capability to solve for absolute parallax. NEAT with 0.6deg field (0.01 rad) will measure "relative" parallax with 100X higher accuracy than Absolute parallax.
  - But with a mission 1 sigma error of 0.05uas, NEAT will measure absolute parallax to 5uas accuracy, better than GAIA.
- The parallax signature (vs RA, DEC) is known, with the ratio of RA, DEC axis and phase fixed, only the amplitude is fitted.
- But the relative parallax of each Ref star must be solved for.

Multiple Planets around Ref Stars

- Naively we assume the ref stars are fixed and solve for the planets around the target star.
- This can be reversed, calling one of the ref stars the target, and assuming the others are fixed to solve for multiple planets around the ref star



In the end, we solve for all the parameters simultaneously

Photon noise in ref star ~3X larger than photon noise of target.
We can detect a signal around the ref star ~3X larger than for the target.

10% of stars have Jupiters

- Down to Neptune, maybe 20~30% of the ref will have a planet. On average, we will have to solve for 3 planets around ref stars along with any planets around the target star.
- # measurements >># unknowns
  - #unknowns = 7*# planets + 5*#stars,
    - #planets is the total # planets, 3 around ref stars.
  - #measurements = 2*#epochs * (N-1), N~9 stars.
  - For the target star #epochs*2>>7*#planets+5