Abstract

Malhotra (1993, 1995) was the first to consider Neptunian migration as having an effect on the population distribution of subclasses of KBOs. Additionally, the idea that the early solar system may not have been dynamically stable has led to exploration of what possible “wild days” in the early history of Neptune could have brought about. We will use different variations of the model of Neptunian migration, along with adding in Planet 9 and separately adding in the Oort Cloud to our simulations, to map how the Kuiper Belt possibly dynamically evolved to its present state. We will then compare our results with the OSSOS observational data while limiting the chances of observational bias.

“Oort” You Glad/There May be a Ninth Planet?

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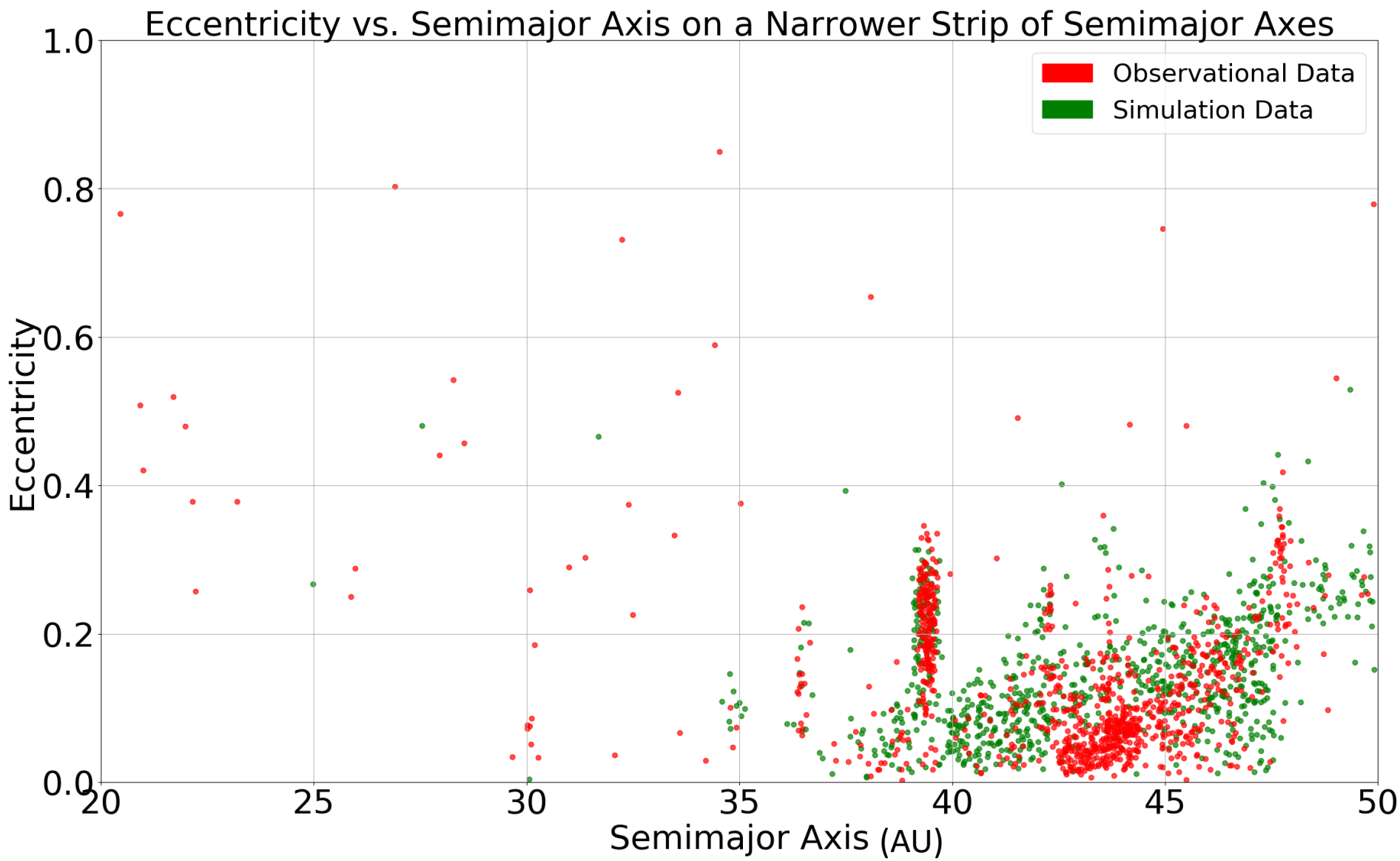
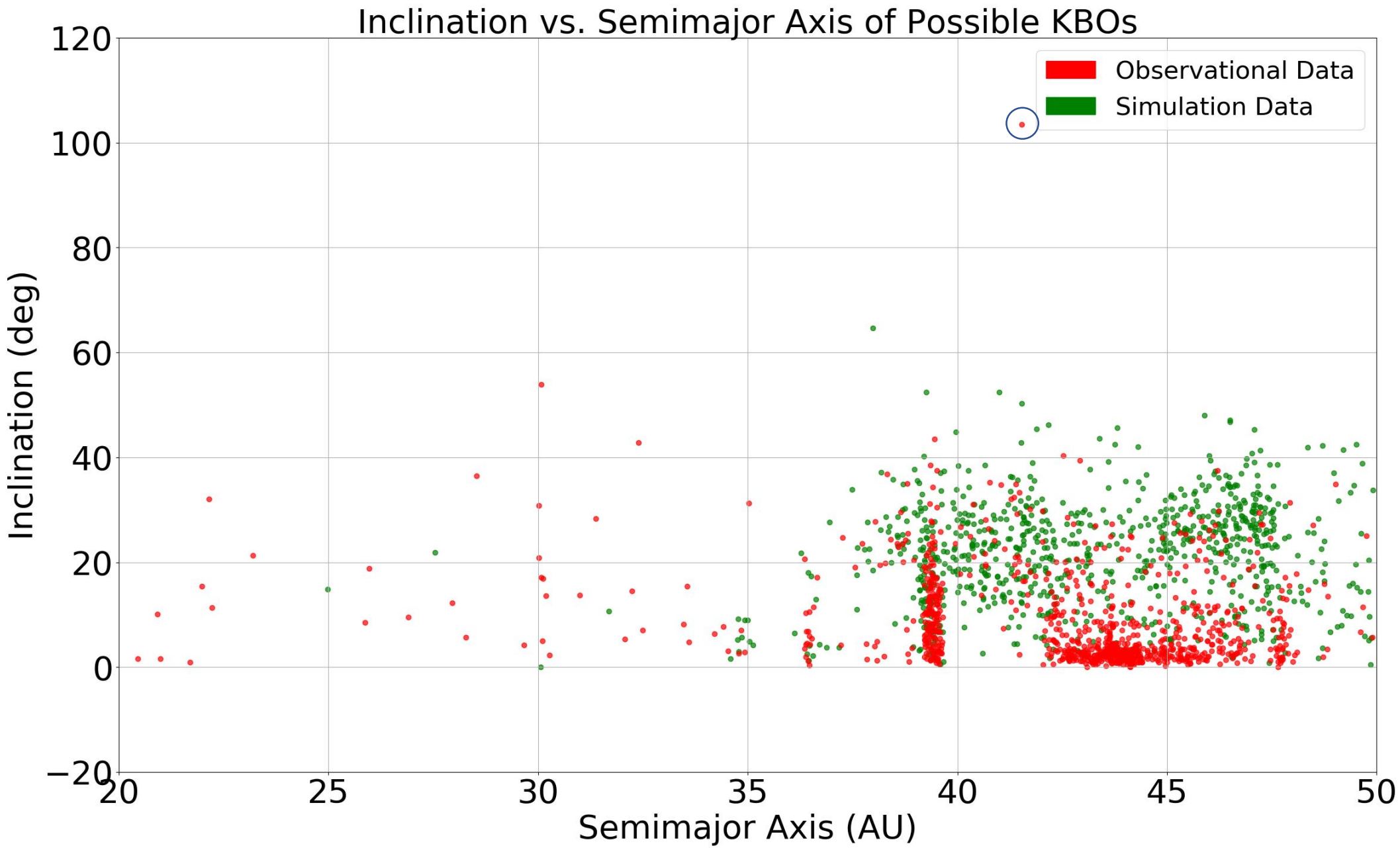
Kuiper Belt: How did it Form, and So What?

- 4 groups:
  - Resonance
  - Classical
    - hot (HC)
    - Cold (CC)
  - Scattered disk objects (SDOs)
  - Detached objects


Eccentricity vs. Semimajor Axis on a Narrower Strip of Semimajor Axes
Observational Data
Simulation Data
Eccentricity
Semimajor Axis (AU)
0.0
0.2
0.4
0.6
0.8
1.0
20
25
30
35
40
45
50

Neptunian Migration

- Generally agreed-upon:
  - Neptune probably started at about 24 AU (astronomical units) from sun
  - Instability at ~28 AU
  - KBOs scattered to beyond 30 AU (Neptune's current location)
- Goal: Using our model of the migration of Neptune, along with other factors, map how the Kuiper Belt dynamically reached its present state.


Inclination vs. Semimajor Axis of Possible KBOs
Observational Data
Simulation Data
Inclination (deg)
Semimajor Axis (AU)
120
100
80
60
40
20
0
−20
20
25
30
35
40
45
50

Summer Work

- Simulation work
  - Planet 9
  - Oort Cloud

- Tools of the Trade
  - Outer Solar System Origins Survey (OSSOS)
  - Python