Characteristics To Be Explained by Theory

1. Planets lie roughly in the same plane
2. Orbit plane coincides with Sun's equator
3. All planets' and sun's rotation are prograde
4. Planetary orbits mostly low eccentricities
5. Most angular momentum in planets
6. Meteorites show high T inclusions
7. Planets show a compositional gradient

Stages in Forming a Solar System

a. Interstellar Gas Cloud.
b. Instability (pressure wave from nearby supernova explosion?) leads to local density increase which exceeds Virial critical value.
c. Protostar forms at center of cloud.
d. Protoplanets form in nebular disk.
e. ProtoSun begins hydrogen fusion.
f. Disk cools, planetary accretion continues.
g. Sun goes through "T-Tauri phase." Strong solar wind which occurs a few million years after the onset of fusion in the stellar core. Blows away all remaining gas, clearing the nebula.
h. With the removal of the nebula, planetary accretion ends.

A Recipe for Making Planets

Step 1: From dust 1 μm (10^{-6} m) to cm sizes.
Particles stick together electrostatically.

Step 2: From cm to km sizes.
Inelastic collisions, particles stick together.

Step 3a (Terrestrial Planets): From 1 km to >1000 km.
In each zone, a single large planetesimal dominates. Efficiency increased by "gravitational focusing."
Impacts of the last few remaining large planetesimals could account for the differing obliquities, rotation rates, et

Step 3b (Jovian Planets): Gravitational Accretion.
Largest planetesimals dominate their zones *gravitationally* as a "feeding zone."
As mass increases, feeding zone widens.
Very rapid, very efficient process.
Formation of large satellites may follow as secondary condensation regions around the massive primary.