

Where we are from?

Interstellar medium

Star and Planet Formation

Astrobiology

Outstanding Questions

- How do molecular clouds collapse to form stars?
- How do very young stars evolve?
- How do planets grow in circumstellar disks?
- Are there observations unique to SKA that address these questions?

Major Challenges

- How do planets grow in circumstellar disks?
- Dust to pebbles to boulders
- How do very young stars evolve?
- Let there be light
- How do molecular clouds collapse to form stars?
- Magnetic fields are to astronomers what sex is to psychologists (van de Hulst by way of Crutcher)

Growing planets in disks

- cm-wave observations probe particle sizes larger than mm
 - distribution of particle sizes in “older” disks for comparison with models
- cm-wave continuum: few x 1000 km baselines
 - detect concentrations > 2 mas, few M_{\oplus}
- cm-wave molecular lines – amino acids (life)
 - compact concentrations complex molecules
- survey numerous disks

Consistent with suggestions by Wilner in SKA Science
Upper frequency cut-off 22-24 GHz

How do disks evolve?

- Real-time protoplanetary/protostellar disk evolution - **movies of disks in formation**

- High sensitivity, 2 AU resolution cm-wave observations

(100K, 0.2 mas, 8 GHz bandwidth, A/T 10,000)

- proper motions (Reid – Bryden et al 1999)
- dynamical timescales months-years

How do very young stars evolve?

- cm-waves probe inner few AU of accretion disks (optically thick at mm-wavelengths)
 - comparison with models (Hillenbrand)
 - detect gaps due to massive planet formation (seen in more evolved disks with HST/scattered light)
 - binary star/disk relation
 - detailed observations of outflows at origin in HI, recombination lines (see Hoare SKA Science Book)
 - movies of jets?

Molecular Clouds to Stars

- Cloud collapse regulated by magnetic field or turbulence – fundamental question
 - high resolution, high sensitivity
 - sources (extragalactic) behind cloud cores
 - magnetic fields measured in absorption pre-collapse, in early collapse
 - magnetic support, ambipolar diffusion?
 - Zeeman splitting OH, CCS

Structure of the Milky Way Galaxy

- ?? Compelling arguments for high priority ??