The Interstellar Medium

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Three Phases

- HIM
  - OVI emitting gas.
- WIM/WNM
  - Recombination radiation
- CNM
  - Molecular gas.
- McKee-Ostriker theory.

McKee-Ostriker

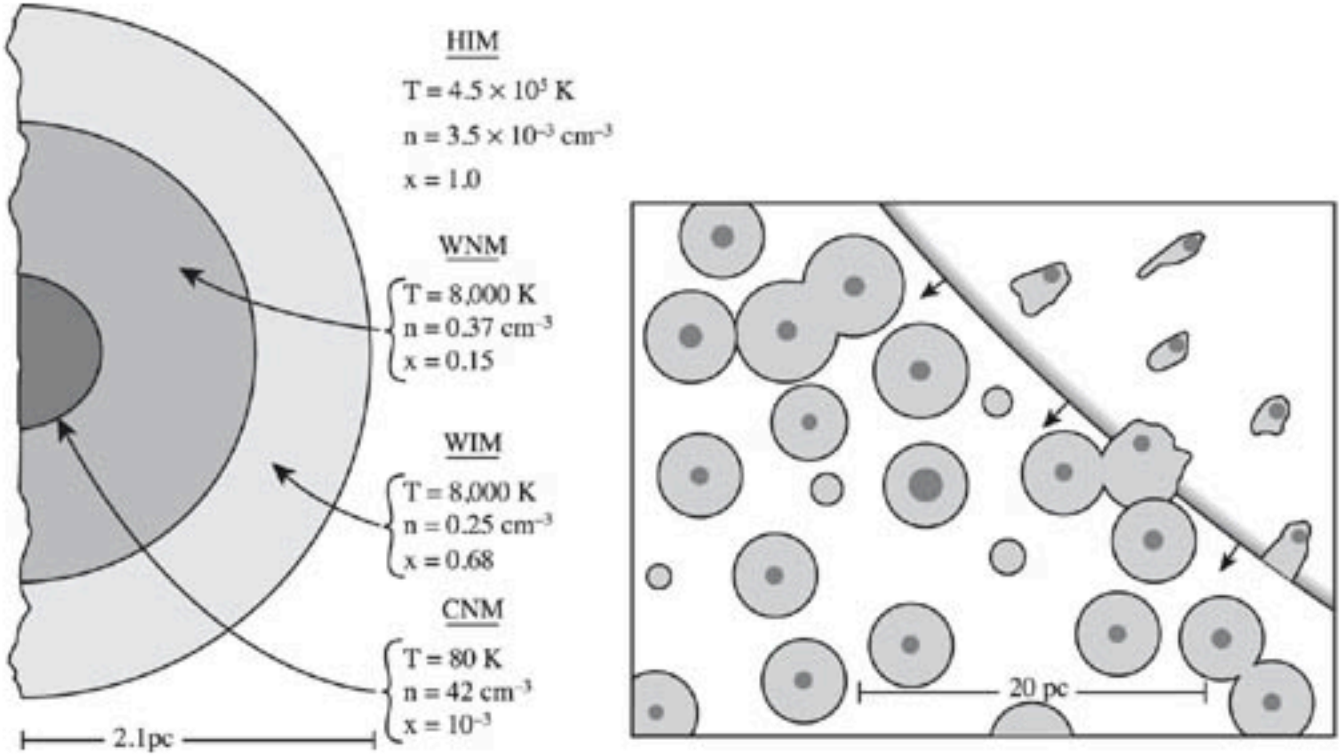


Figure 39.3 Left: Structure of a typical cold cloud in the three-phase model of McKee & Ostriker (1977). Right: Close-up of a supernova blastwave. From McKee & Ostriker (1977).

McKee-Ostriker

- Begin with uniform HI medium.
- A supernova explodes
- Velocity > sound speed => shock.
- Free expansion phase in which ejecta will expand at constant velocity.
  - Reverse shock propagating inwards.

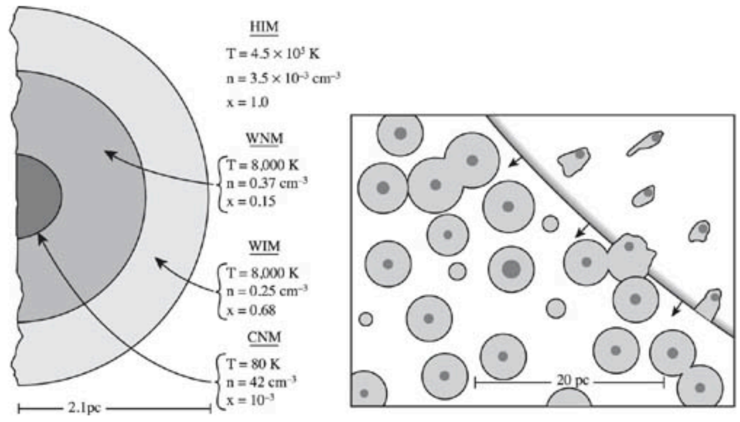


Figure 39.3 Left: Structure of a typical cold cloud in the three-phase model of McKee & Ostriker (1977). Right: Close-up of a supernova blastwave. From McKee & Ostriker (1977).

McKee-Ostriker

- Continues until ejecta mass = swept-up mass.
- Enter Sedov-Taylor phase.
  - Hot inside the shock.
  - Radiation losses low.
  - Pressure inside much higher than pressure outside.
  - Treat it as a point explosion into a uniform medium.

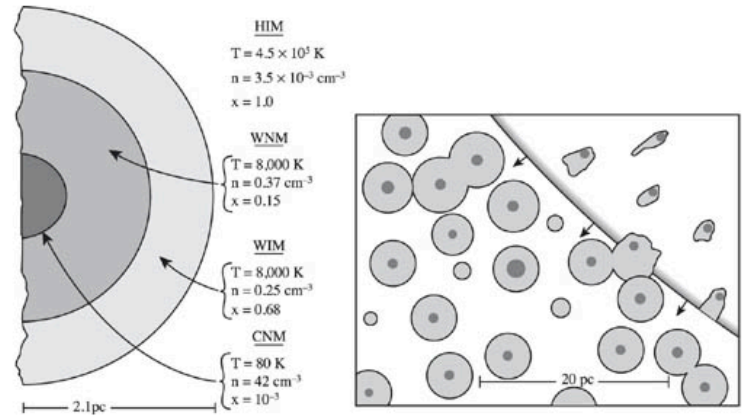


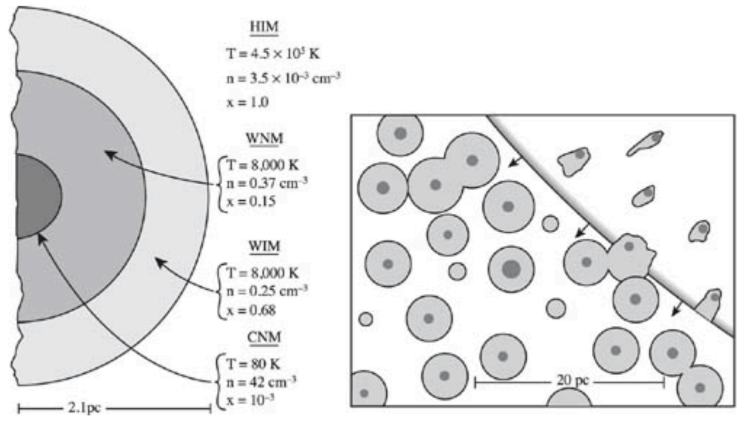
Figure 39.3 Left: Structure of a typical cold cloud in the three-phase model of McKee & Ostriker (1977). Right: Close-up of a supernova blastwave. From McKee & Ostriker (1977).

McKee-Ostriker

- Radiative losses become important.
- Temperature of outer shell drops.
  - Interior is still hot.
- Snowplow phase.
  - Pressure from inside pushes outer shell.
- Fades into ISM when shock speed approaches sound speed.

McKee-Ostriker

- Overlapping SNR will fill most of ISM with hot gas.
- Will convert two phase medium into three in a few Myr.
- Also stellar winds.



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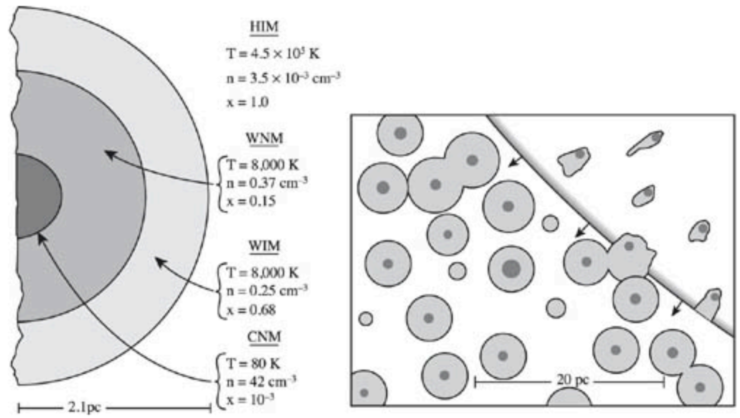
McKee-Ostriker

- Key concepts:
  - Pressurization of ISM by SN.
  - Cold clouds evaporated into diffuse gas.
  - Diffuse gas compressed and cooled in shells.
  - Did not predict large amount of warm gas.



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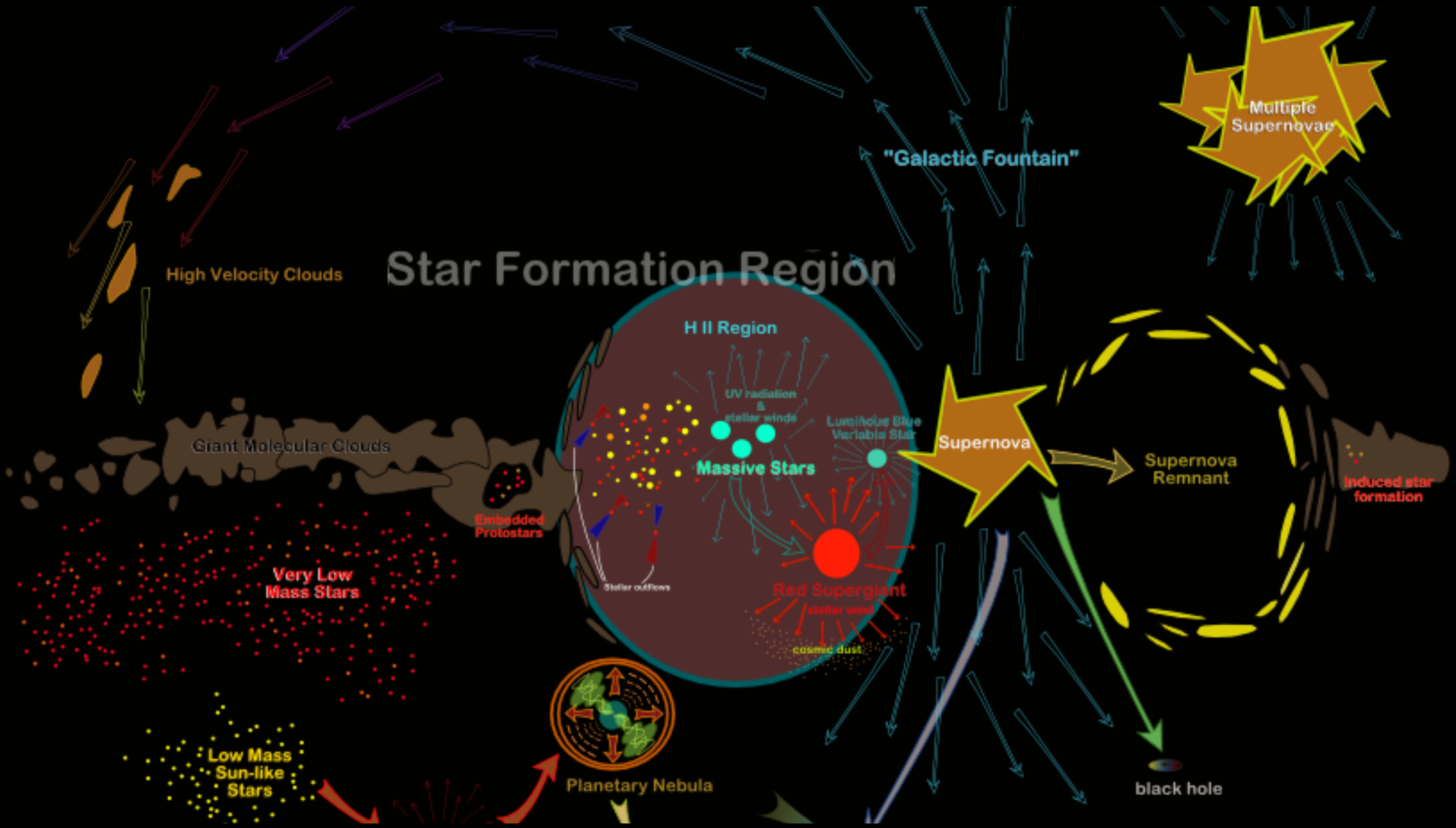
The Galaxy



Multiple Supernovae
"Galactic Fountain"
High Velocity Clouds
Star Formation Region
H II Region
UV radiation & stellar winds
Luminous Blue Variable Star
Massive Stars
Supernova
Supernova Remnant
Induced star formation
Giant Molecular Clouds
Embedded Protostars
Very Low Mass Stars
Stellar outflows
Red Supergiant
stellar wind
cosmic dust
Low Mass Sun-like Stars
Planetary Nebula
black hole