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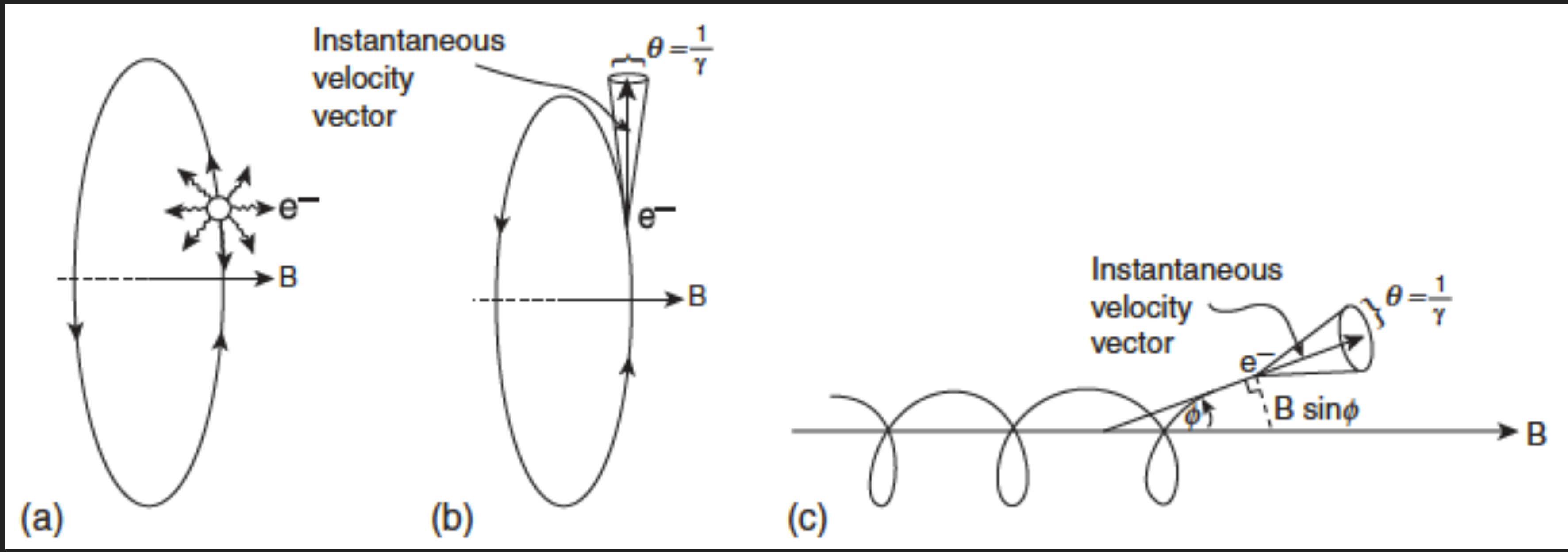
RADIO HALOS AND SYNCHROTRON RADIATION

CONTENTS

- Synchrotron radiation
- Spectral Index
- Radio Halos

SEEING MAGNETIC FIELDS



- Synchrotron radiation comes from relativistic electrons interacting with magnetic fields
- Like Bremsstrahlung, it is the result of an electron changing its momentum by “scattering” off a field
- In order to preserve momentum, it emits a photon in the corresponding direction in order to conserve momentum

SEEING MAGNETIC FIELDS

- From J. A. Irwin *Astrophysics:*

$$\nu_0 = \frac{eB}{2\pi m_e c}$$

$$\left[\frac{\nu_0}{\mathrm{MHz}}\right] = 2.8 \left[\frac{B}{\mathrm{Gauss}}\right]$$

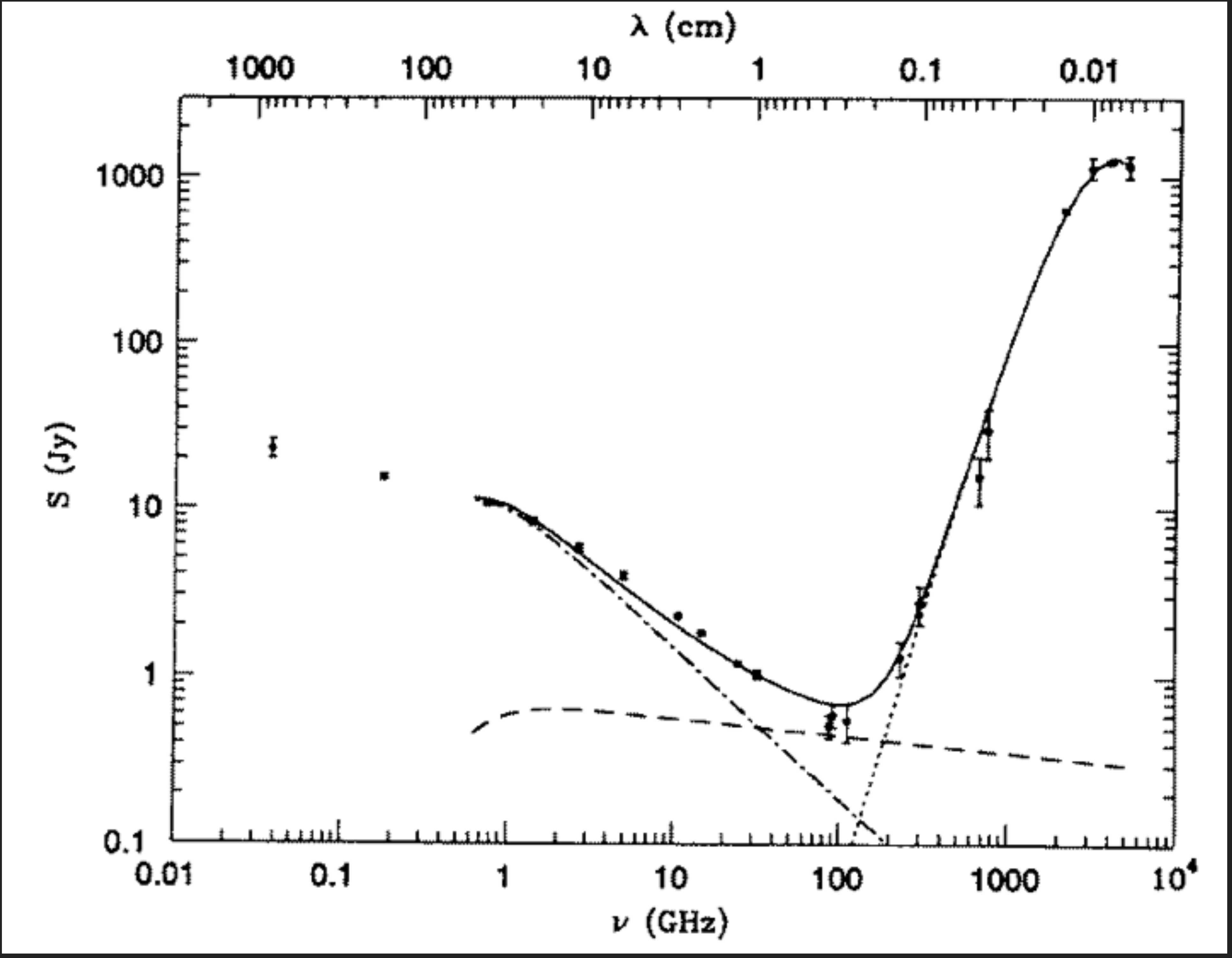
- Synchrotron radiation is a continuous, rather than a line emission

SPECTRAL INDEX

- Like a blackbody, the intensity of the radio halo varies predictably with frequency
- Instead of following the Stefan-Boltzmann law, the radio spectrum is approximated as a power law:

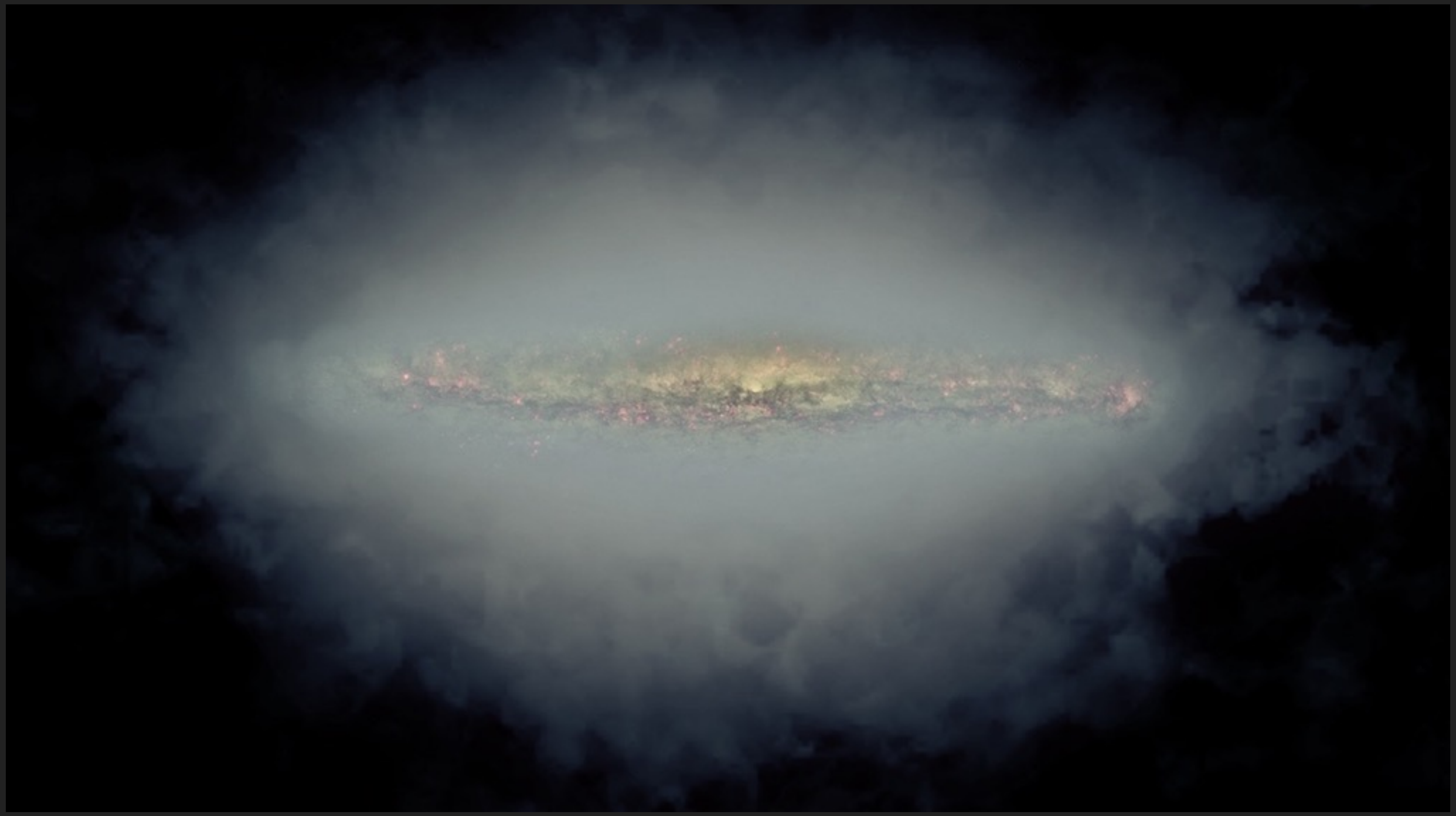
$$L_\nu \propto \nu^{-\alpha}$$

SPECTRAL INDEX



BEYOND THE DISC

- Radio emission extends well above and below the disc of a galaxy



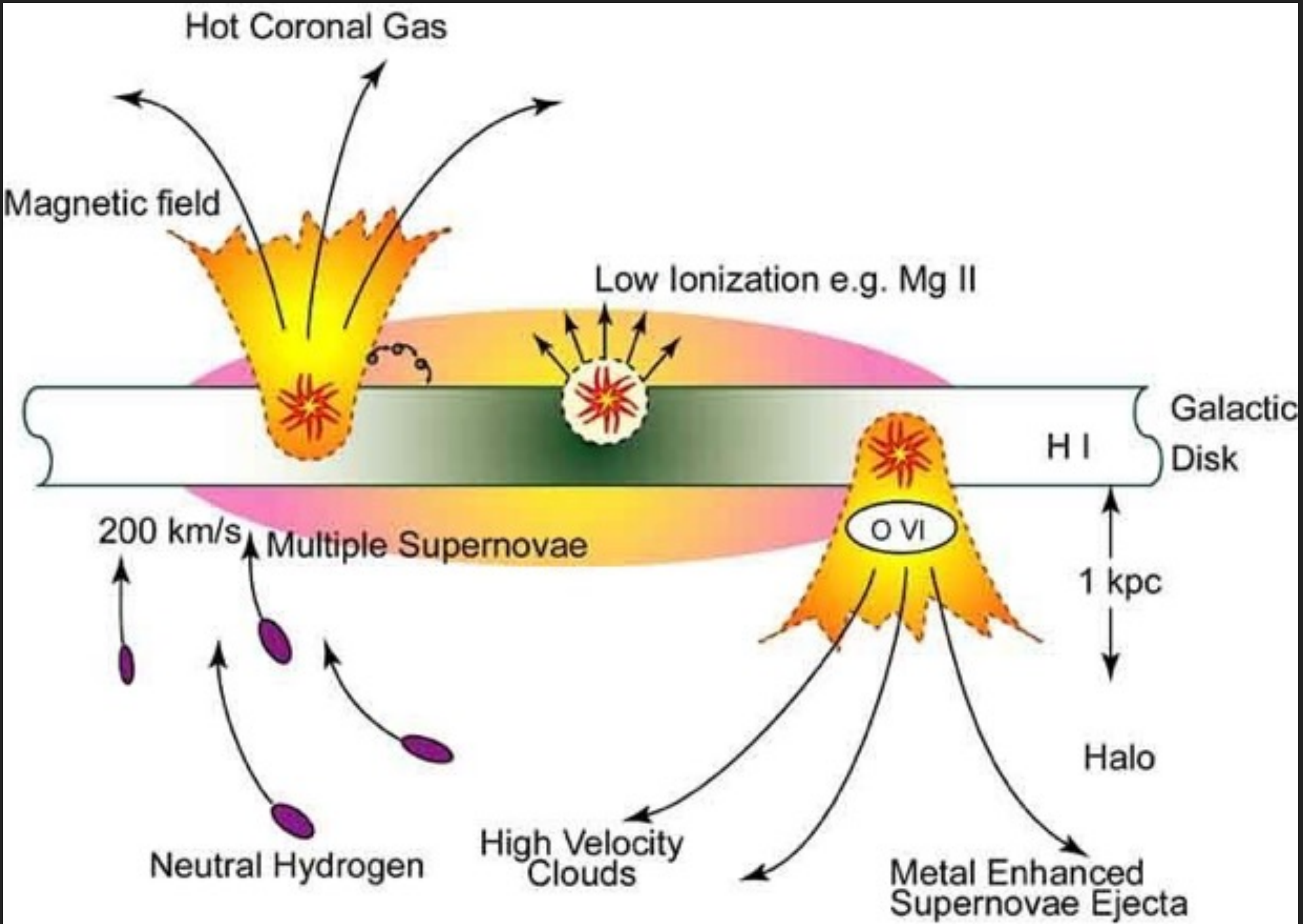
- Generally synchrotron radiation

CLUSTERS

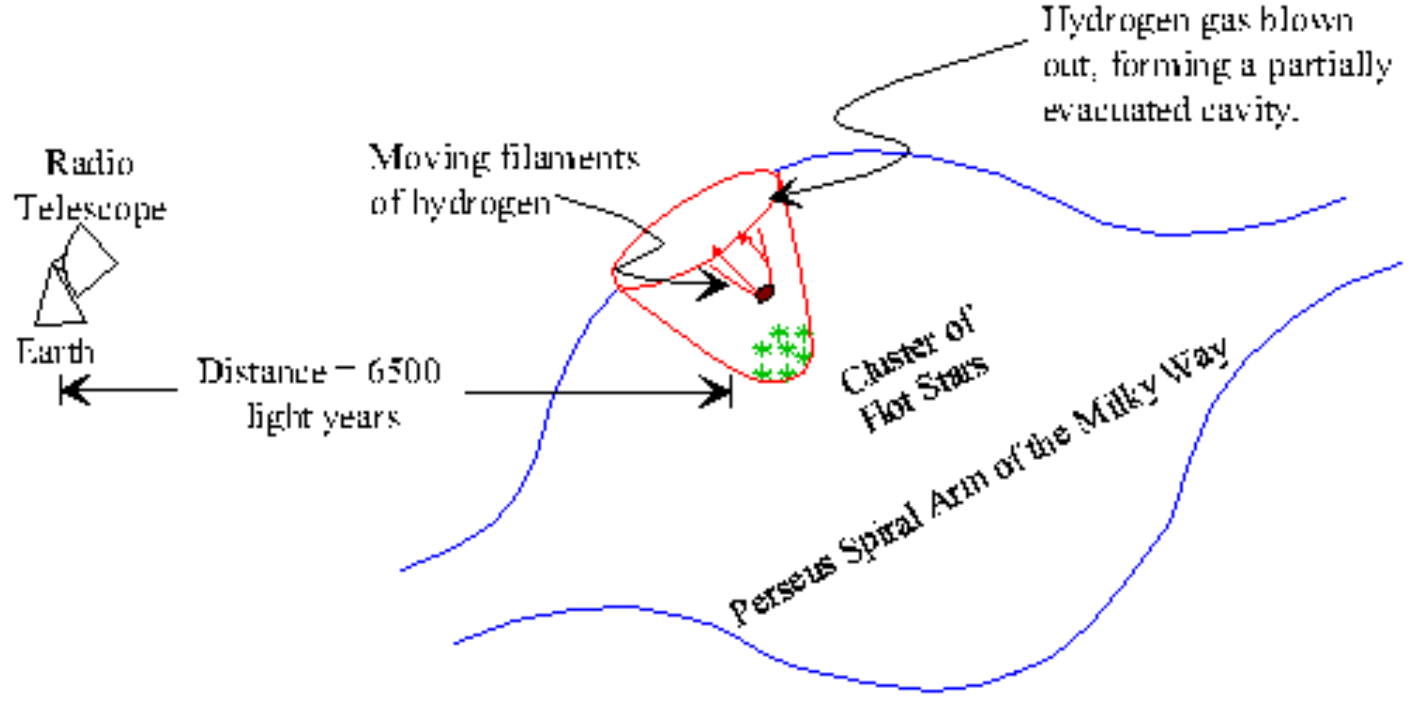
- Also present in large galactic clusters, where the radio emission has no apparent parent galaxy.

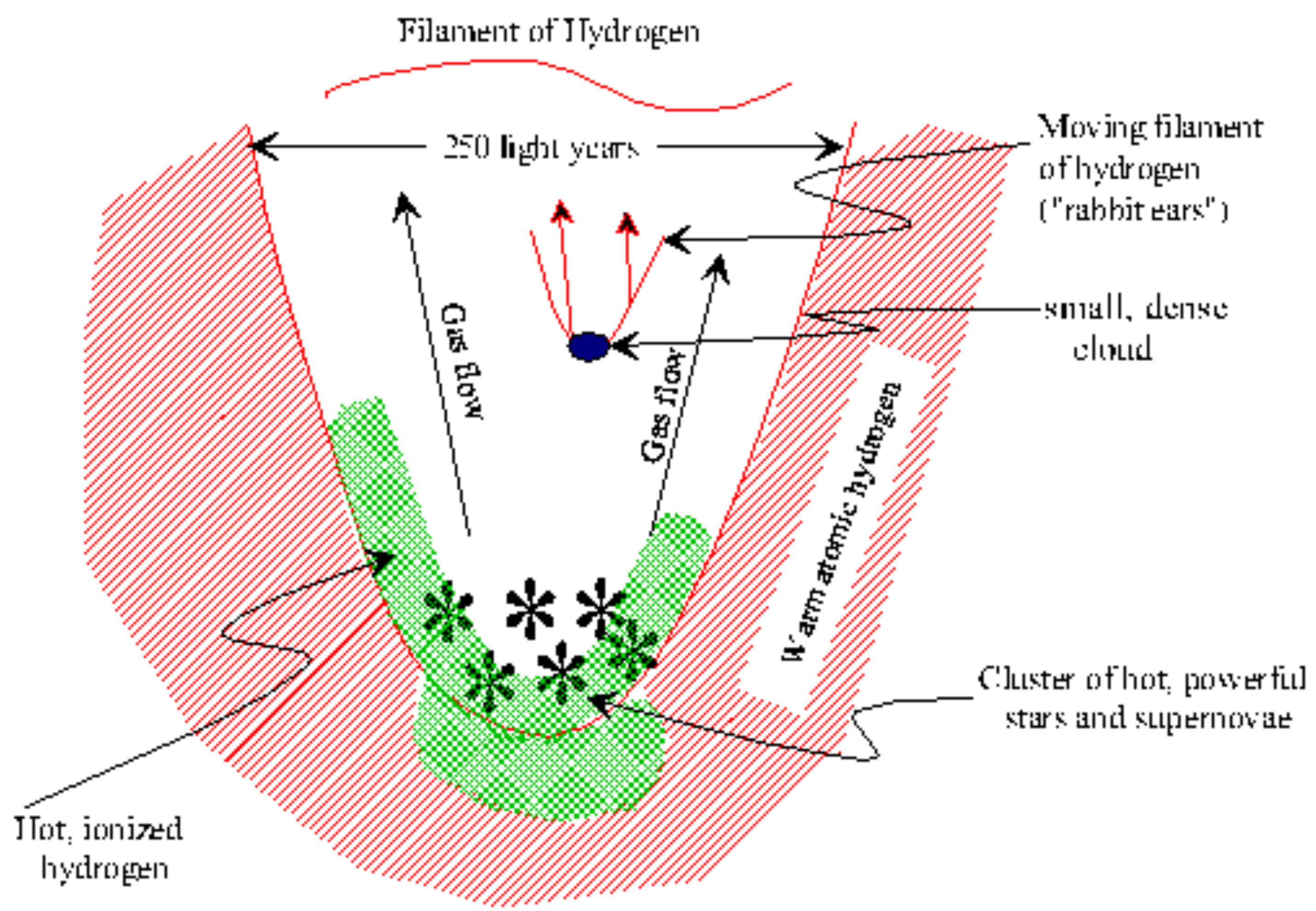
SOURCE

- Radio halos are now thought to be the result of galactic "Chimneys" venting the hot ionized gas from supernovae into the galactic halo



A "Chimney" in the Milky Way





WHAT DO WE LEARN FROM THEM?

- Star formation rates
- Winds from supernovae
- Galactic magnetic fields
- Cosmic ray generation and transport
- Active Galactic Nuclei