Investigating a Potential Milky Way Radio Halo

Nitika Yadlapalli, Vikram Ravi

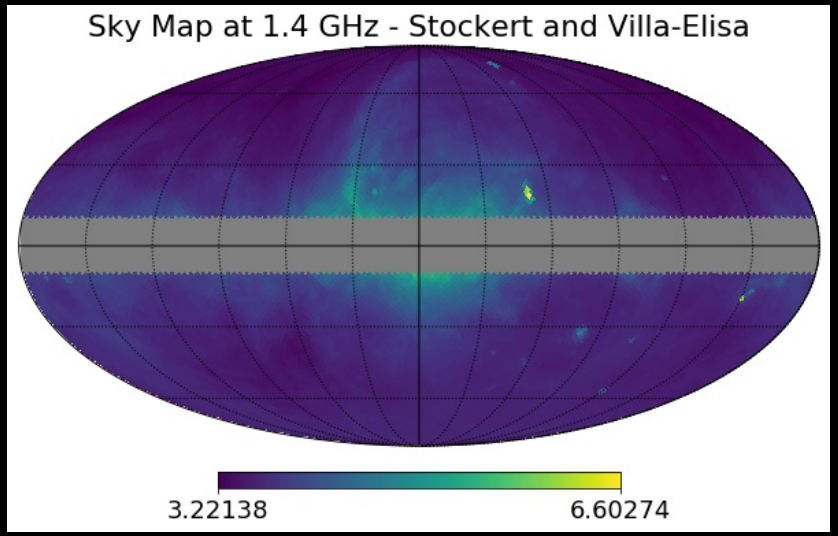
Department of Astronomy, California Institute of Technology

Components of the Radio Sky

$$T_{sky}\left(\nu, l, b\right) =$$

Components of the Radio Sky

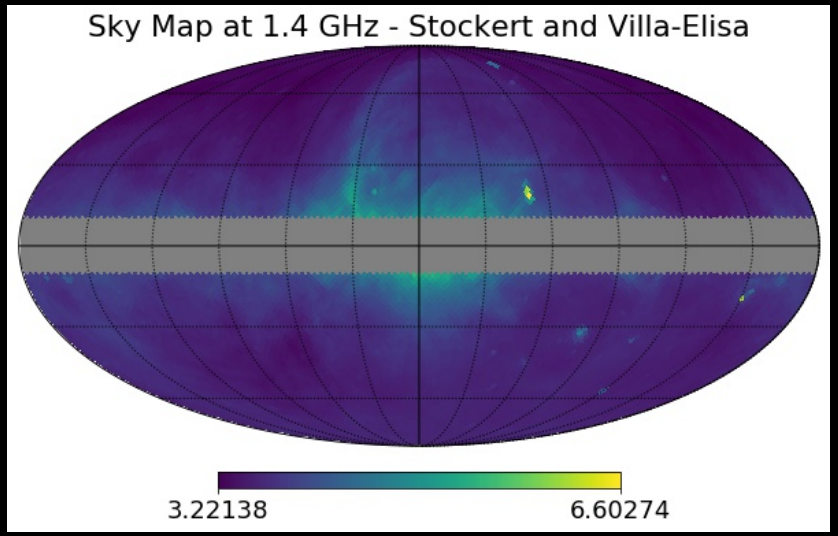
$$T_{sky}\left(\nu, l, b\right) =$$



(Reich & Reich 1986)

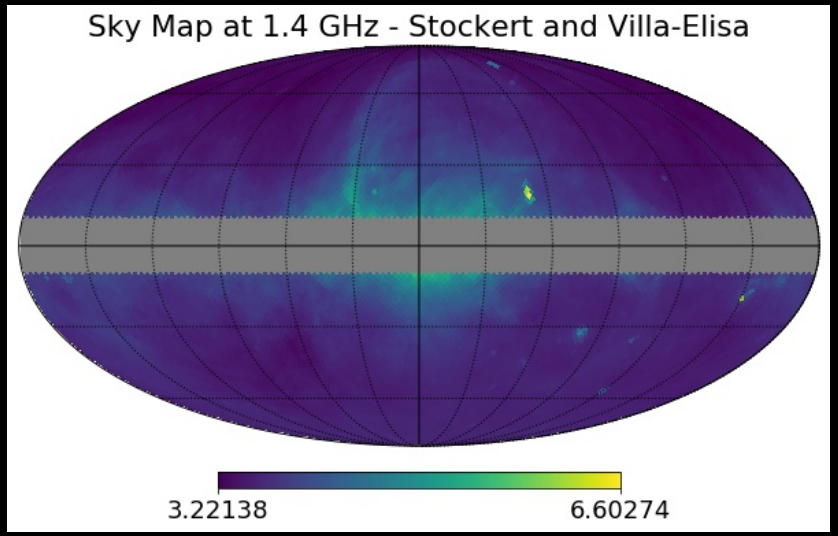
Components of the Radio Sky

$$T_{sky}\left(\nu, l, b\right) = T_{gal}\left(\nu, l, b\right)$$



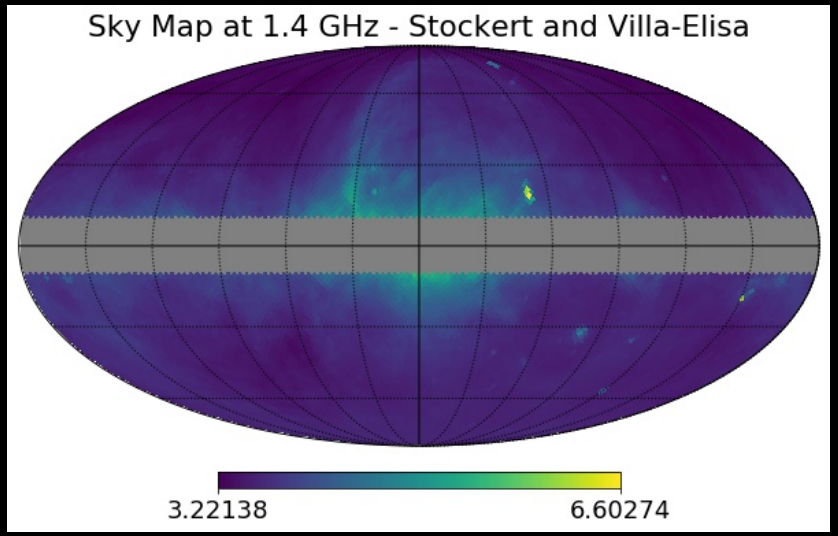
Components of the Radio Sky

$$T_{sky}(\nu, l, b) = T_{gal}(\nu, l, b) + T_{EG}(\nu) \quad \sim 0.1\,\mathrm{K}$$



Components of the Radio Sky

$$T_{sky}(\nu, l, b) = T_{gal}(\nu, l, b)$$

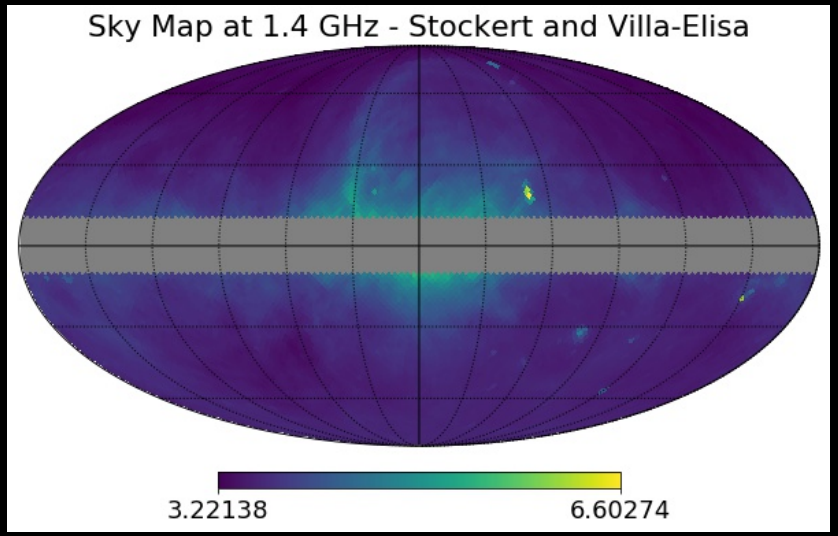


$$+ T_{EG}(\nu) \quad \sim 0.1\,\mathrm{K}$$

$$+ T_{CMB} \quad 2.7\,\mathrm{K}$$

Components of the Radio Sky

$$T_{sky}(\nu, l, b) = T_{gal}(\nu, l, b)$$



$$+ T_{EG}(\nu) \quad \sim 0.1\,\mathrm{K}$$

$$+ T_{CMB} \quad 2.7\,\mathrm{K}$$

$$+ ?$$

Components of the Radio Sky

$$T_{sky}(\nu, l, b) = T_{gal}(\nu, l, b)$$
$$+ T_{EG}(\nu) \quad \sim 0.1\,\mathrm{K}$$
$$+ T_{CMB} \quad 2.7\,\mathrm{K}$$

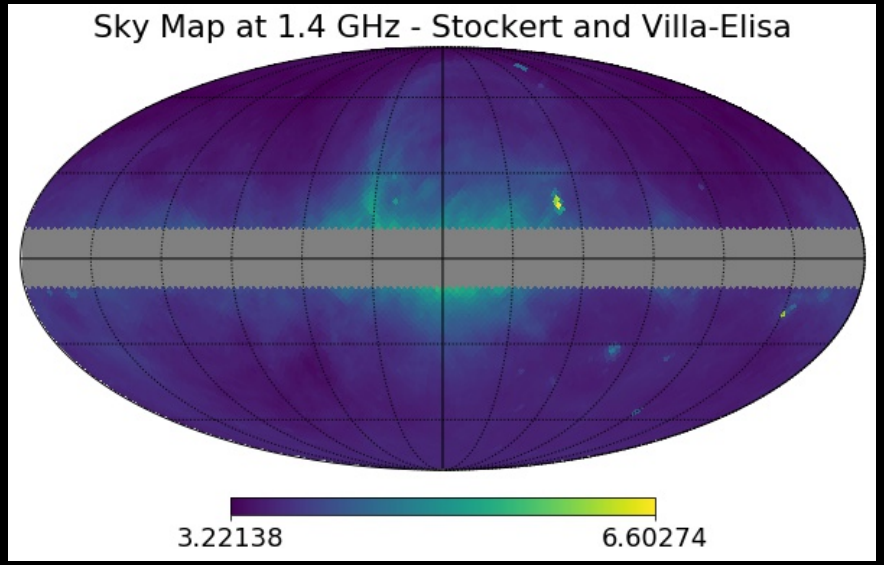
$+ \ ?$

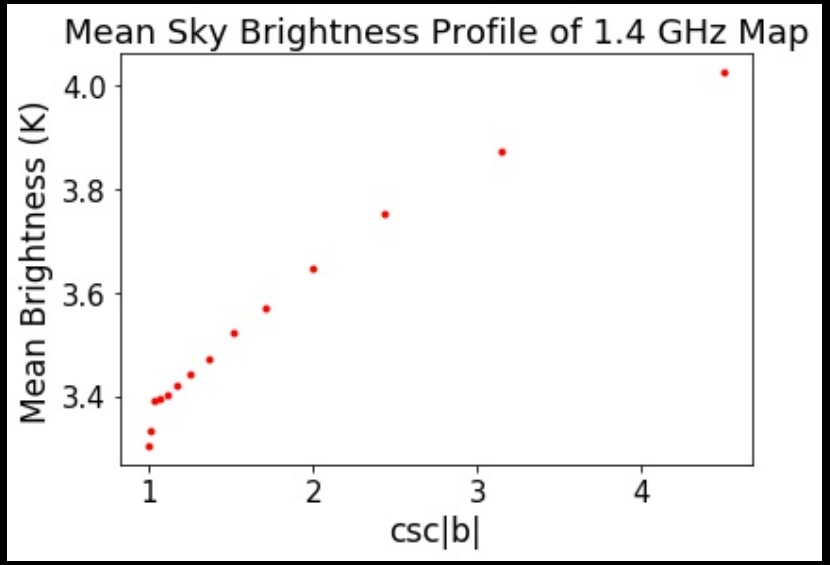
ARCADE 2: ~0.5 K at 1 GHz

(Seiffert et al. 2011)

Galactic Foreground Modeling

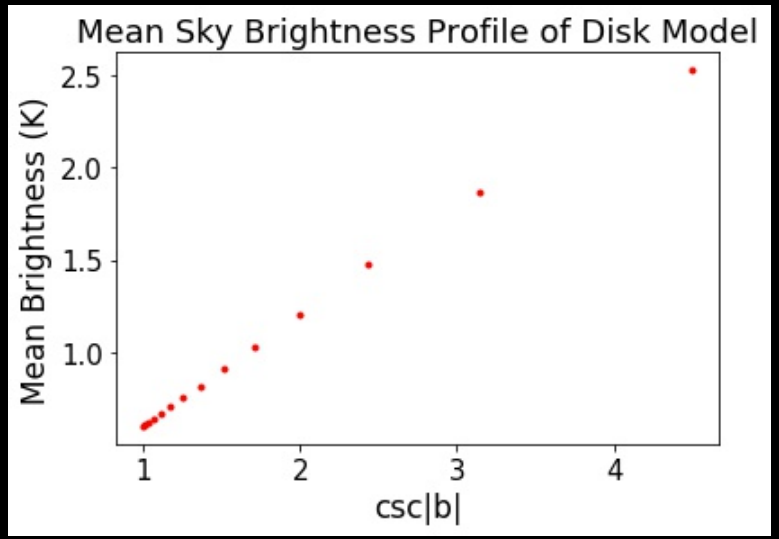
The Plane Parallel Slab Model





Galactic Foreground Modeling

The Plane Parallel Slab Model



$$T_A(\nu, b) = c(\nu) + T_G(\nu)\, csc(|b|)$$

(Kogut et al. 2011)

Galactic Foreground Modeling

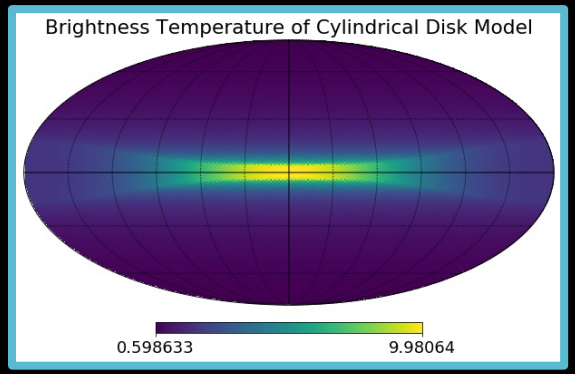
Disk + Halo Model

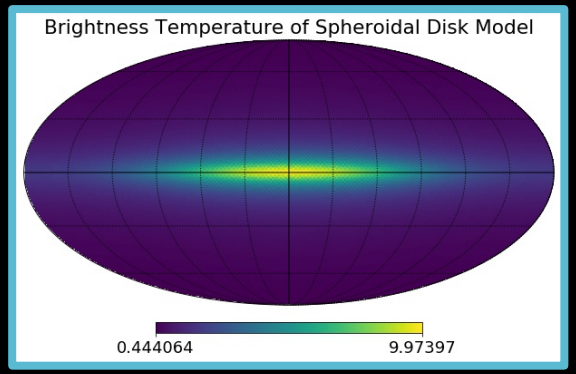
$$T_{gal}(\nu, l, b) = T_{disk}(\nu, l, b) + T_{halo}(\nu, l, b)$$

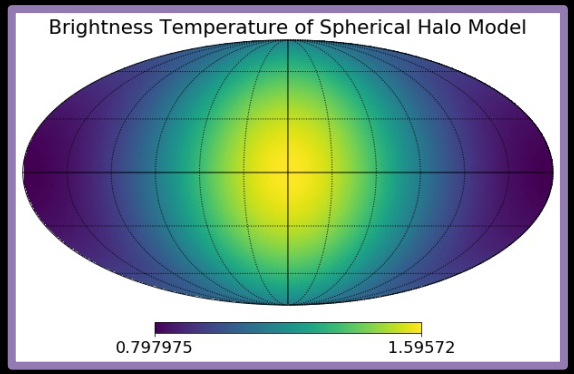
Galactic Foreground Modeling

Disk + Halo Model

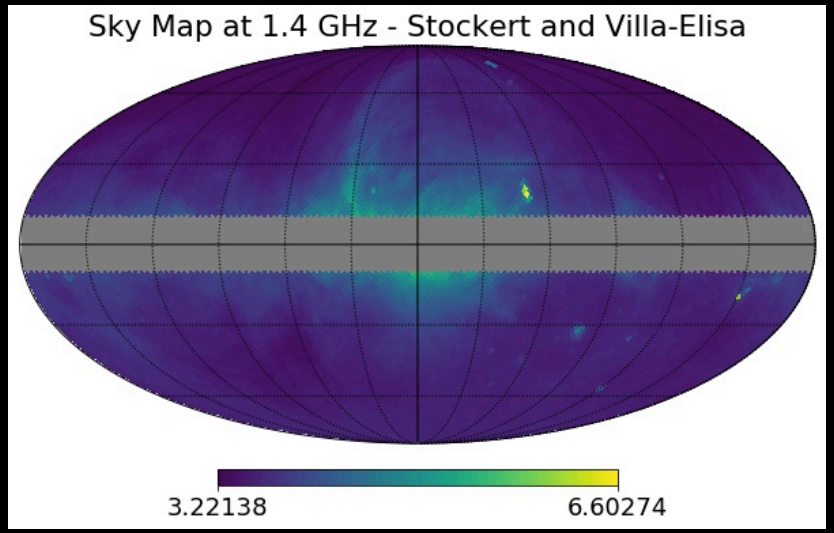
$$T_{gal}(\nu, l, b) = T_{disk}(\nu, l, b) + T_{halo}(\nu, l, b)$$



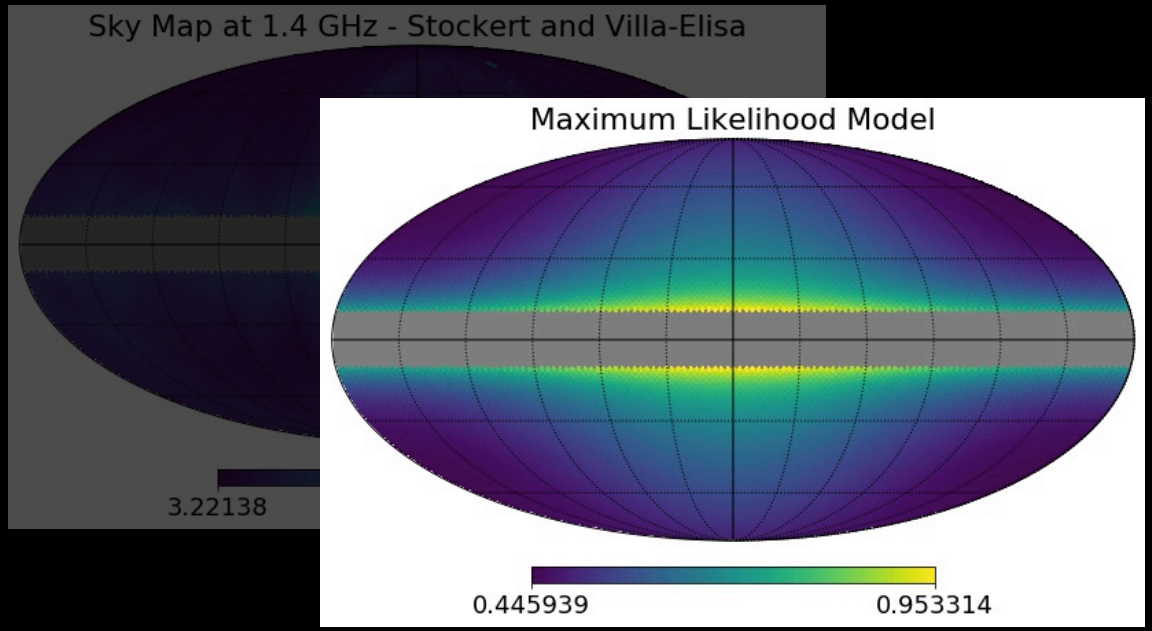




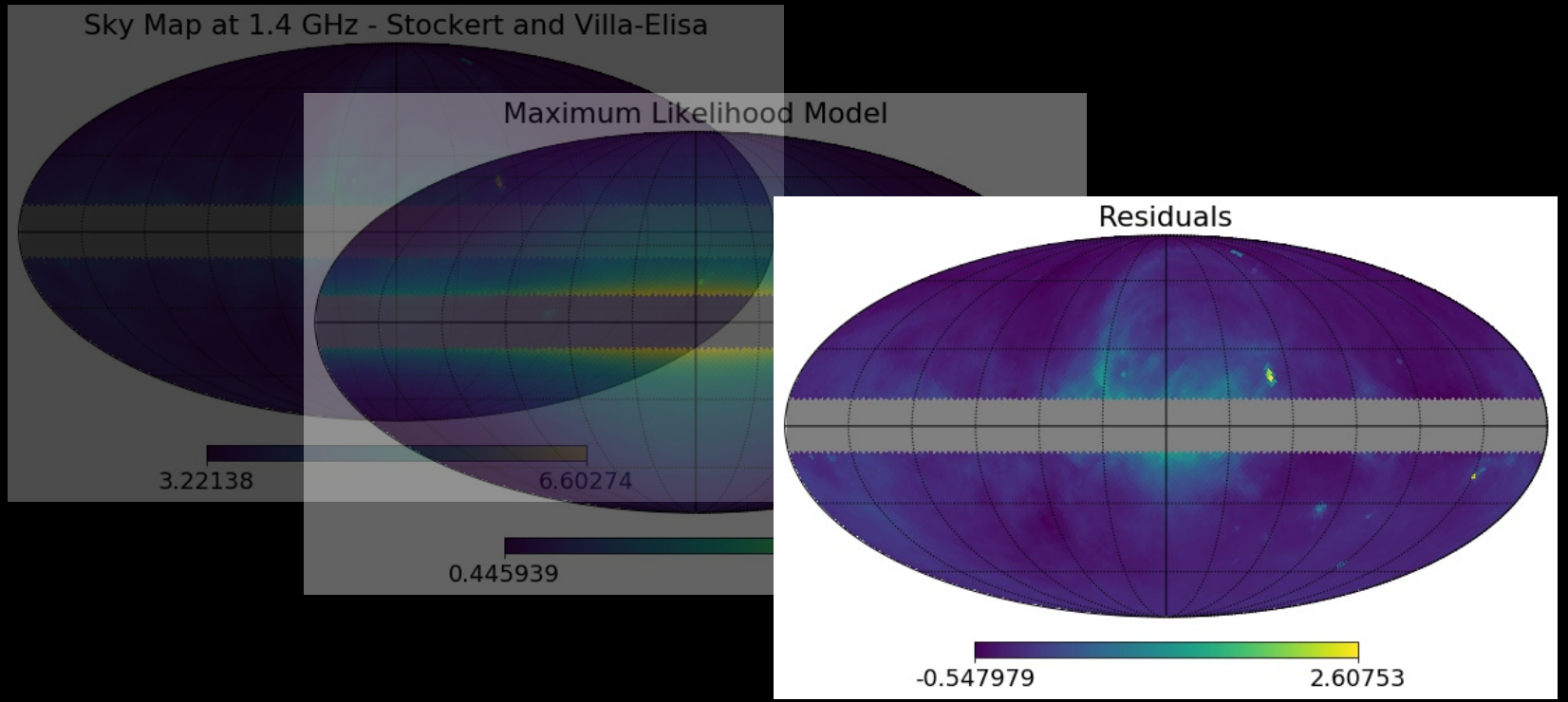
Analyzing All-Sky Map



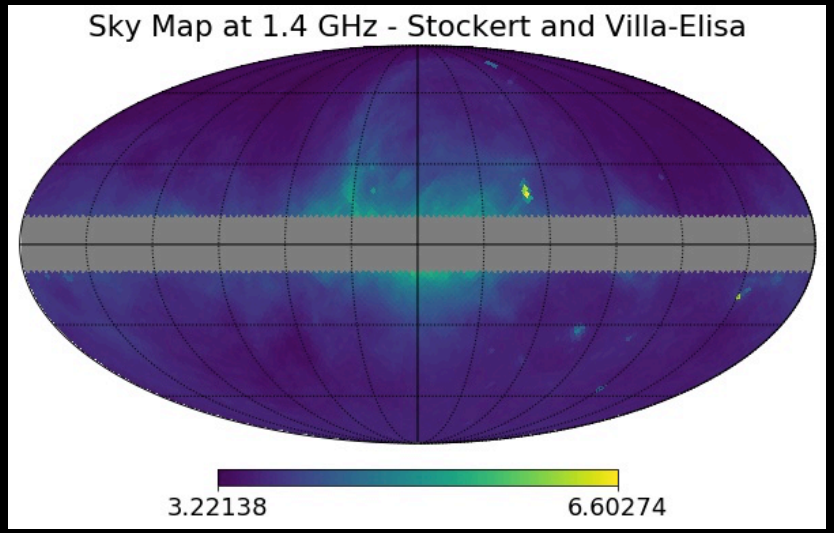
Analyzing All-Sky Map

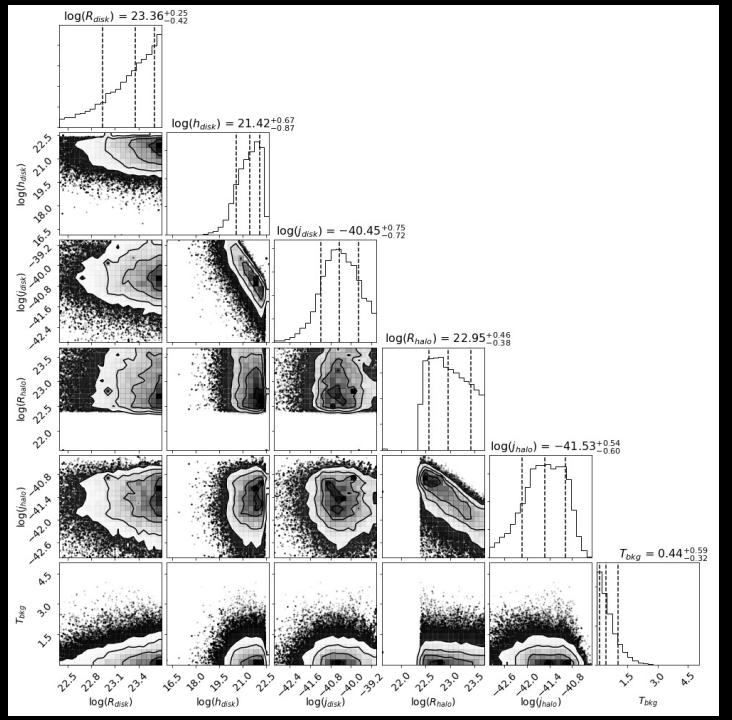


Analyzing All-Sky Map

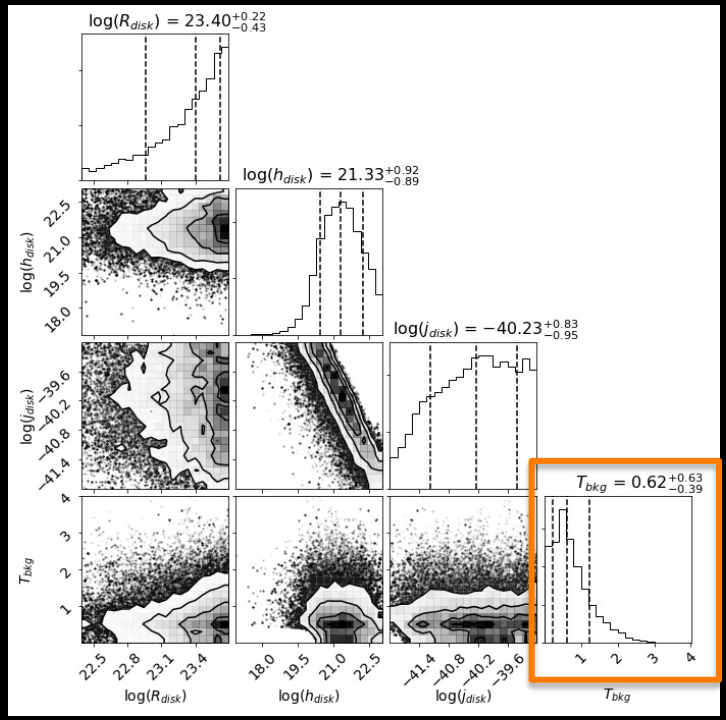


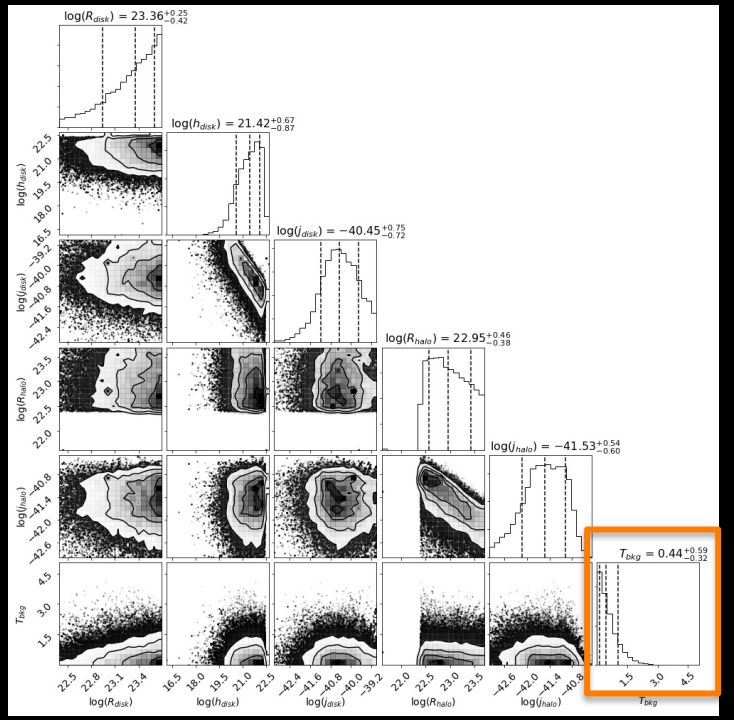
Analyzing All-Sky Map





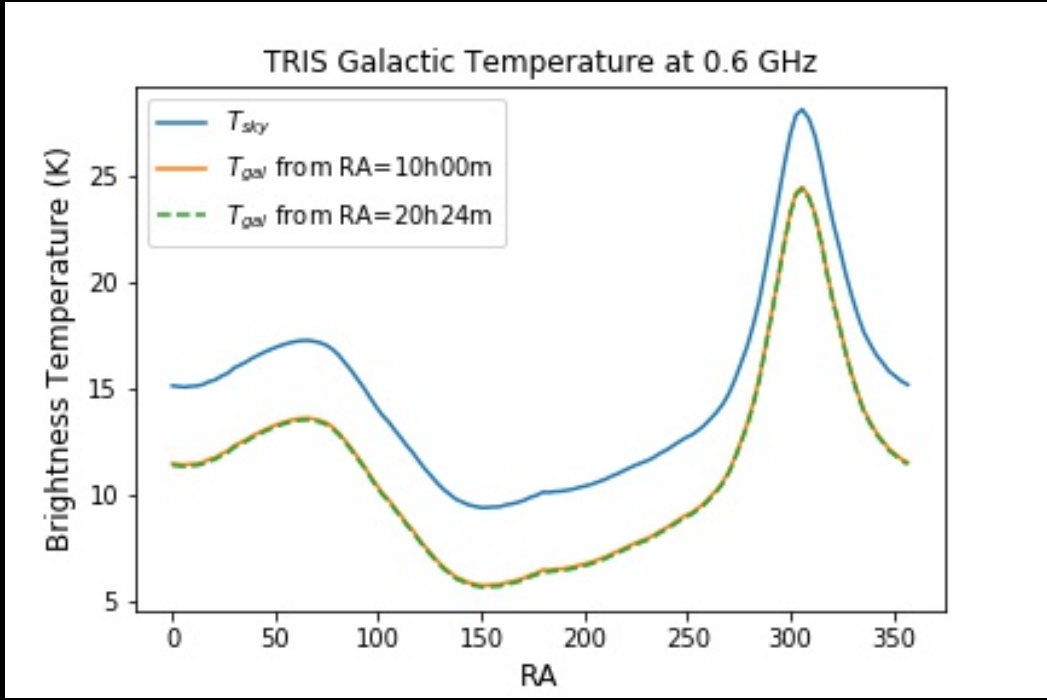
Analyzing All-Sky Map



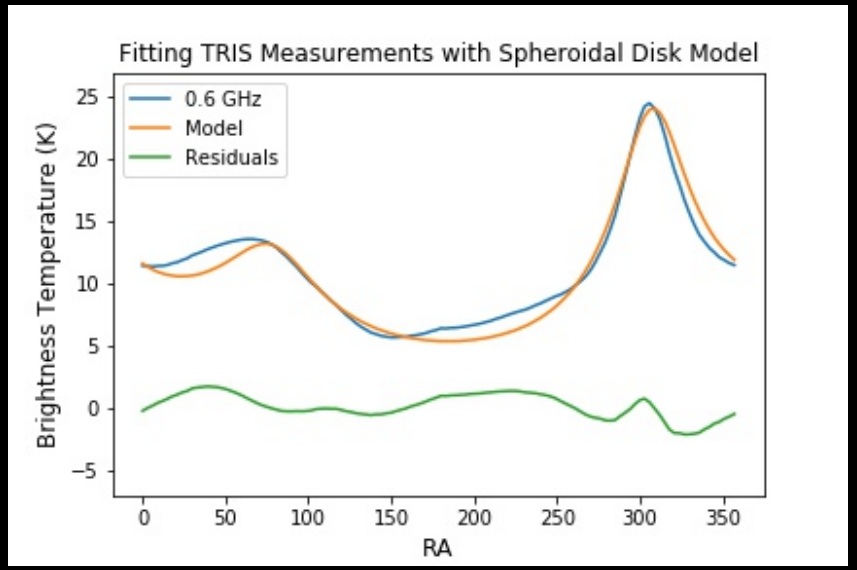


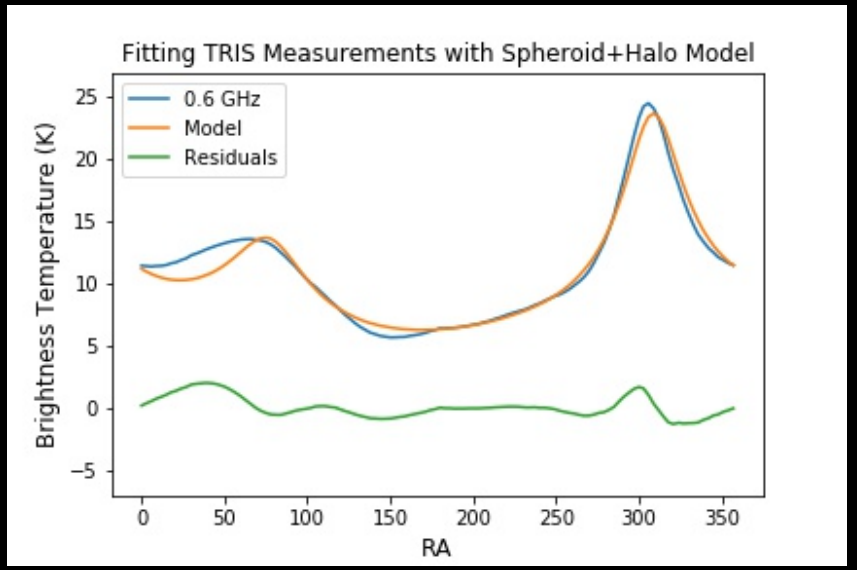
Analyzing TRIS Data

Analyzing TRIS Data

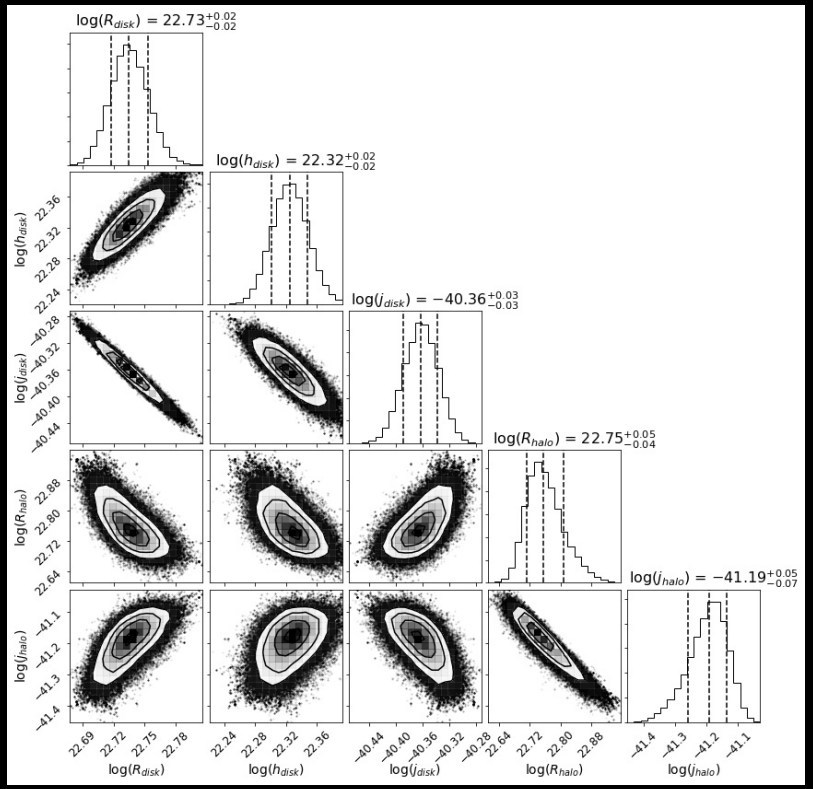


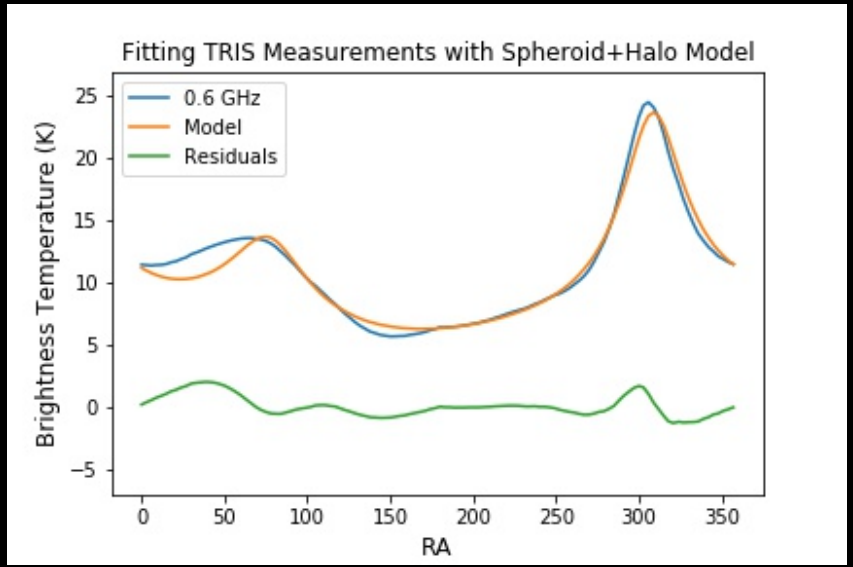
Analyzing TRIS Data





Analyzing TRIS Data

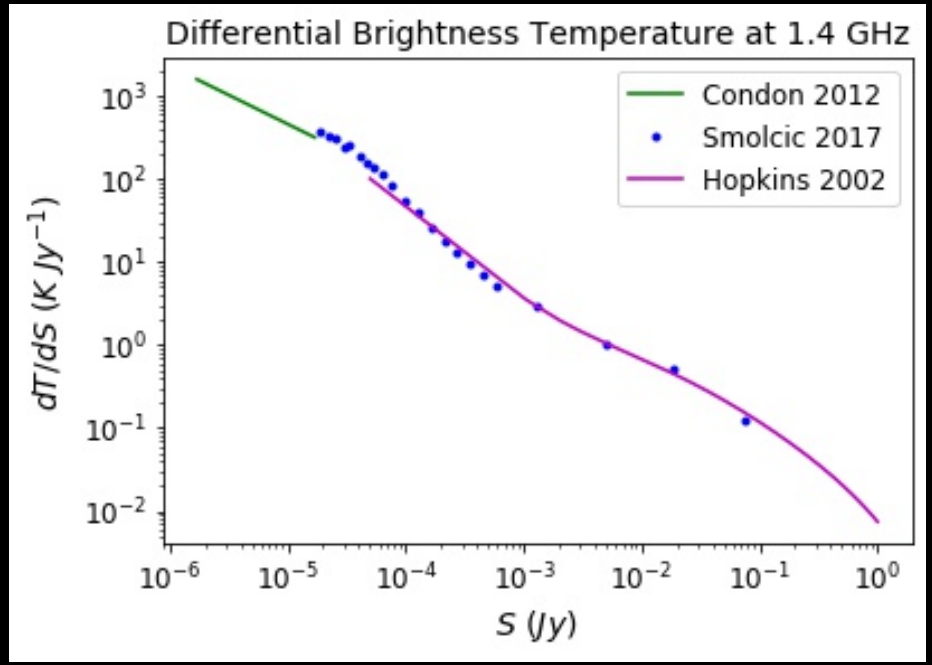




Final Thoughts

$$T_{sky}(\nu, l, b) = T_{gal}(\nu, l, b) + T_{EG}(\nu) + T_{CMB} + ?$$

Extragalactic Brightness Temperature



Brightness Temperature

$$B_\nu = \frac{2h\nu^3}{c^2}\frac{1}{e^{h\nu/kT}-1}$$

$$e^{h\nu/kT} \approx 1 + \frac{h\nu}{kT}$$

$$I_\nu = \frac{2h\nu^3}{c^2}\frac{kT}{h\nu} = \frac{2kT\nu^2}{c^2}$$

$$\boxed{T_b = \frac{I_\nu c^2}{2k\nu^2}}$$

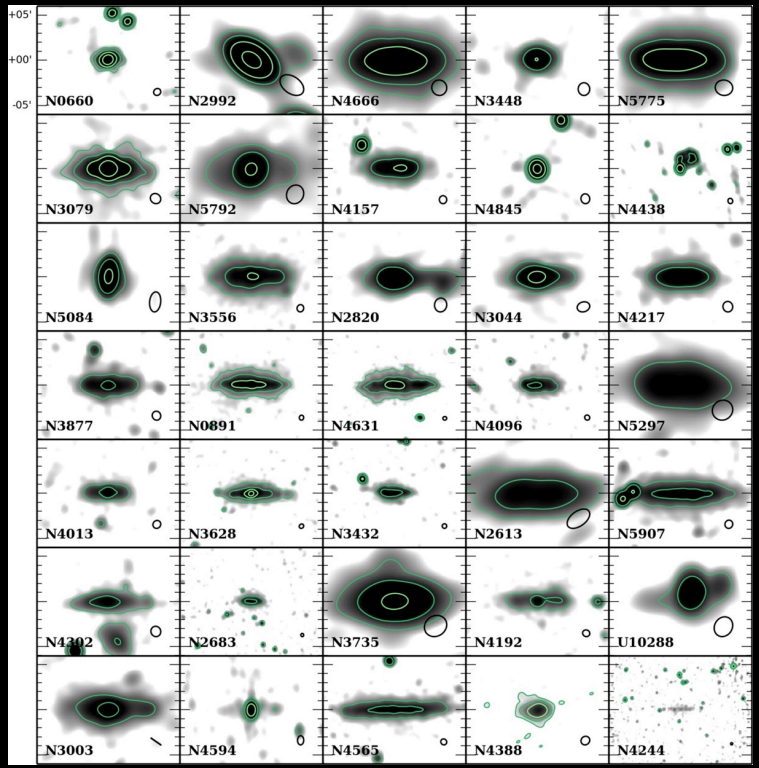
Electron Cooling Time

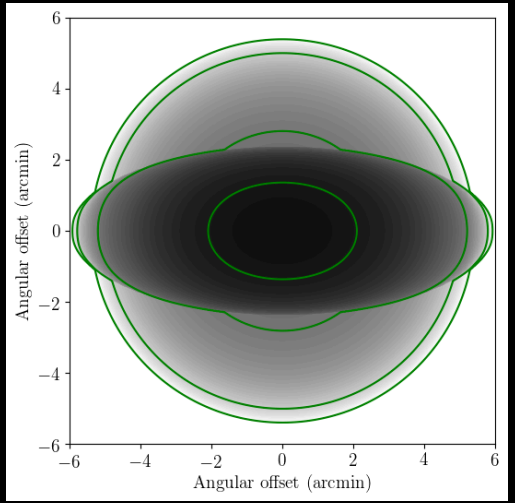
$$E = \gamma m_e c^2$$

$$P_{tot} = P_{sync} + P_{IC} = \frac{4}{3}\sigma_T c \beta^2 \gamma^2 \left(u_B + u_{rad}\right)$$

$$t_{cool} = \frac{E}{P_{tot}}$$

Extragalactic Halos





Wiegert et al 2015