import numpy as np

— Constants — mu0 = 4 * np.pi * 1e-7 Vacuum permeability (H/m) mp = 1.6726e-27 Proton mass (kg) $\text{seconds}_per_year = 365.25 * 86400 L_effective = 1.5e8 Effectiveglobal Alfvénlengthscale(m) B = 1e-4 Typicalsolarmagneticfield(T)$

def $\text{solar}_cycle_years(n_e, N_recon, charge_factor)$: """$Computesfullsolarcyclelengthinyearsusing SDO-basedcharge-drivenmodel. n_e : electrondensity(m^-3) N_recon : numberofreconnectioneventscharge_factor : charge-drivenmodulationfactor"""$ $v_A = B/np.sqrt(mu0 * mp * n_e) Alfvénspeed(m/s) tau_A = L_effective/v_A Alfvéntransittime(s) half_cycle = tau_A * N_recon/charge_factormin ß max full_cycle = 2 * half_cycle min ß min return full_cycle/seconds_per_year$

Cycle 24 $\text{n}_e24 = 2.4e8 * 1e6 N_recon24 = 3.28e5 charge_factor24 = 2.205 cycle24_years = solar_cycle_years(n_e24, N_recon24, charge_factor24)$

Cycle 25 $\text{n}_e25 = 3.8e8 * 1e6 N_recon25 = 3.42e5 charge_factor25 = 3.25 cycle25_years = solar_cycle_years(n_e25, N_recon25, charge_factor25)$

$\text{cycle24}_years, cycle25_years$

Solar cycle python

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1 Introduction