My Universe: Age Calculation

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Universe Age Calculation: Step 1

- Input the six 'fractional density' Omega parameters through the fields or sliders: Ω_r, Ω_m, Ω_{dm}, Ω_{cs}, Ω_{dw}, Ω_{cc}.

Universe Age Calculation: Step 2

- Calculate the sum of the six Omega parameters:

$$\Omega_{sum} = \Omega_r + \Omega_m + \Omega_{dm} + \Omega_{cs} + \Omega_{dw} + \Omega_{cc}$$

Universe Age Calculation: Step 3

- If $\Omega_{sum} < 1$, the Universe is **Open**.

  Such a universe has negative curvature. The open universe will continue to expand forever .

- If $\Omega_{sum} = 1$, the Universe is **Flat**.

  Such a universe has no curvature. This is the slowest forever expanding universe.

- If $\Omega_{sum} > 1$, the Universe is **Closed**.

  Such a universe has positive curvature. The closed universe will only expand for a finite duration, has a maximum radius and ends in a "Big Crunch."

Universe Age Calculation: Step 4

- Numerically calculate the integral:

$$F(1) = \int_0^1 \frac{ds}{sf(s)}$$

where *s* corresponds to 1/redshift and

$$f(s) = \sqrt{\frac{1-\Omega_{sum}}{s^2} + \frac{\Omega_r}{s^4} + \frac{\Omega_{dm}+\Omega_m}{s^3} + \frac{\Omega_{cs}}{s^2} + \frac{\Omega_{dw}}{s} + \Omega_{cc}}$$

Universe Age Calculation: Step 5

- The age of the universe (in billions of years) with the specified fractional densities is the number:

$$\frac{978}{73} F(1)$$

- This uses the April 2006 WMAP value for the **Hubble parameter** of **73 km/sec/Mpc** (http://map.gsfc.nasa.gov). Any future update should result in substituting the new value in the same units, for number 73 in the denominator.

Universe Age Calculation

- The Universe **type** (closed, flat, open), along with the **calculated age** are displayed above the graphs.

Example:

"This is an Omega=1.03 closed universe with a present age of 8.0 billion years"