COSMIC STRINGS AS A CANDIDATE FOR DARK MATTER. ASTROPHYSICAL FORMULAE

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We consider homogeneous, isotropic universe with arbitrary curvature ($k=0,\pm1$), filled with dust, radiation, Λ-term and a set of noninteracting strings (i.e. scaling as $\rho_s \sim R^{-2}$, hence yielding string dominated universe). For such model we find analytic solution of the Friedman equation using Weierstrass functions. We realize that addition of (rather unrealistic component) stable domain walls ($\rho_w \sim R^{-1}$) to the model, does not essentially complicate the calculations.

Our crucial result is expressing of the radial coordinate χ of an observed galaxy with a redshift z in terms of present values of Hubble constant H_o, deceleration parameter q_o and energy density parameters σ_{ro}, σ_{mo}, σ_{so}, σ_{wo} corresponding to radiation, matter, strings and walls ($\sigma_o \equiv 4\pi\sigma\rho_o/(3H_o^2)$):

$$\chi = P^{-1}\left\{\frac{k}{4\sigma_{ro} + 3\sigma_{mo} + 2\sigma_{so} + \sigma_{wo} - q_o - 1}\left(\frac{4\sigma_{ro} + 3\sigma_{mo} + \sigma_{wo} - q_o - 1}{6}\right.\right.$$

$$-\frac{z+2}{2}\left[\sigma_{mo} + \sigma_{ro}(z+2)\right] + \frac{1}{4z^2}\left(1 + \left[2\sigma_{ro}z^2(z+2)^2 + \right.\right.$$

$$\left.\left.\left.\left. + \sigma_{mo}z^2(2z+3) - \sigma_{wo}z^2 + q_o z(z+2) + (z+1)^2\right]^{\frac{1}{2}}\right)^2\right)\right)\right\},$$

where P is the Weierstrass Elliptic Function (Dąbrowski & Stelmach, 1986, Astron.J., $\underline{92}$, 1272).

Above relation is the starting point for the derivation of the proper astrophysical formulae which may be used for testing cosmological models.

In models without domain walls we just put $\sigma_{wo}=0$.