

## ERRATUM: “A HADRONIC SYNCHROTRON MIRROR MODEL FOR THE "ORPHAN" TeV FLARE IN 1ES 1959+650” (ApJ, 621, 176 [2005])

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In the estimate of the synchrotron radiation energy density from the primary synchrotron flare (eq. [3]), I had neglected to include the numerical value of  $\nu F_\nu(\text{sy})$  as quoted earlier in the paper. With this, equation (3) should read

$$u_{\text{sy}}(R_m) \sim \frac{d_L^2}{R_m^2 c} \nu F_\nu(\text{sy}) \sim 8.2 \times 10^{-5} \Gamma_1^{-4} \Delta t_{20}^{-2} \text{ ergs cm}^{-3}, \quad (3)$$

and equation (4) will be, accordingly,

$$u'_{r,\text{sy}} \sim \frac{\tau_m \Gamma^2 u_{\text{sy}}(R_m)}{4\pi} \sim 6.5 \times 10^{-5} \Gamma_1^{-2} \Delta t_{20}^{-2} \tau_{-1} \text{ ergs cm}^{-3}. \quad (4)$$

Furthermore, equation (5) should include a factor of  $\Delta\gamma'_p$ , representing the width (FWHM) of the  $\Delta$  resonance,  $\Delta\gamma'_p/\gamma'_p \sim \Delta E/E_\Delta \sim 1/2$ . With these corrections, the following equations should read

$$\nu F_\nu(\text{VHE}) \sim \frac{L'_{\text{VHE}} \Gamma^4}{4\pi d_L^2} \sim 1.4 \times 10^{-65} N_p(\gamma'_p) \Delta t_{20}^{-2} \tau_{-1} E_{\text{sy},1}^{-2} \text{ ergs cm}^{-2} \text{ s}^{-1}, \quad (6)$$

$$N_p(\gamma'_p) \sim 2.2 \times 10^{55} \Delta t_{20}^2 \tau_{-1}^{-1} E_{\text{sy},1}^2, \quad (7)$$

$$N_p \sim 2.2 \times 10^{56} \frac{(300)^s}{s-1} \Gamma_1^{1-2s} \Delta t_{20}^2 \tau_{-1}^{-1} E_{\text{sy},1}^{2-s}, \quad (8)$$

$$n'_p \sim 5 \times 10^{12} \Gamma_1^{-3} \Delta t_{20}^2 \tau_{-1}^{-1} R_{16}^{-3} \text{ cm}^{-3} \quad (s=2), \quad (9)$$

$$E'_{b,p} \sim 1.2 \times 10^{57} \Gamma_1^{-2} \Delta t_{20}^2 \tau_{-1}^{-1} \text{ ergs}, \quad (10)$$

$$L_p^{\text{kin}} \sim 2.7 \times 10^{50} R_{16}^{-1} \Delta t_{20}^2 \tau_{-1}^{-1} f_{-3} \text{ ergs s}^{-1}. \quad (11)$$

The estimates concerning the  $\pi^+$  production and decay, and the resulting (optical) secondary synchrotron flare, remain unaffected by these changes.

Equations (9)–(11) indicate that unreasonably high values of the relativistic proton density and hadronic jet power would be required in the model's original form.

However, it should be noted that a similar synchrotron mirror model may still be viable if one takes into account the contribution of reflected synchrotron radiation of the blob as it travels close to the reflector. Although the synchrotron luminosity drops by a factor of a few between the primary synchrotron outburst and the orphan TeV flare, the proximity of the synchrotron-emitting source (replacing  $R_m$  by a distance  $r \lesssim R_b$  in eq. [3]) will bring the proton density and kinetic luminosity estimates back down into the range of their values in the original paper. Details of this modified scenario will be presented in a forthcoming publication (S. Postnikov & M. Böttcher 2006, in preparation).