EFFECT OF MAGNETIC FIELD ON SOLAR NEUTRINO FLUX

(Abstract)

K. J. FRICKE
Universitäts Sternwarte, Göttingen, F.R.G.

At Göttingen Observatory Mrs D. Bartenwerfer has considered the effect of a strong magnetic field in the solar core on the solar neutrino flux. The solar neutrino flux is calculated in the same way as in the paper by Bahcall and Ulrich (1971). The unperturbed Sun with composition $X=0.734$, $Y=0.245$ has then a neutrino flux $\Sigma_0 \simeq 10$ SNU. This flux can be reduced when – in average – a magnetic field

$$B^2(M_r) = \tfrac{4}{3} \int_{M_r}^{M} (\omega^2/r)\, \mathrm{d}M_r$$

is assumed in the solar interior. Here ω is an equivalent rotation law

$$\omega = (\omega_c - \omega_s) \exp(-b(M_r/M)^2) + \omega_s ,$$

where for ω_s the observed surface angular velocity is taken and b and ω_c are adjustable parameters; the central field strength, B_c, is then a function of ω_c and b. The choice $B_c = 1.4 \times 10^9$ G, $b=22.2$ results in the neutrino flux $\Sigma = 0.08$ $\Sigma_0 = 0.8$ SNU. Bahcall and Ulrich (1971) did not obtain this strong reduction since they admitted – for stability reasons – only fields which do not peak in the center. Here no stability consideration has been made but it is suggested that the gradient of molecular weight in the Sun prevents the field from bubbling up to the surface.

References

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