R-matrix analysis of the $^{10, 11}B(p, \alpha_{0,1})^{7, 8}Be$ reactions at stellar energies

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The available astrophysical S(E) factor and angular distribution experimental data for the $^{10}B(p, \alpha_{0, 1})^{7}Be$ and $^{11}B(p, \alpha_{0, 1})^{8}Be$ reactions have been analyzed within the R-matrix theory over the stellar energy ranges up to E(c.m.) = 1.0 MeV and 1.45 MeV, respectively. In the case of the latter reaction, the measured data are satisfactorily account for by simply assuming contributions from the two well known levels of the ^{12}C compound nucleus at E_x = 16.11 MeV ($J^{\pi} = 2^{+}$) and 16.57 MeV (2^{-}), and from an additional sub-threshold level located at E_x = 15.44 MeV. Besides, the drastic enhancement shown by the low energy part of the S (E) factor data in the $^{10}B(p, \alpha_{0, 1})^{7}Be$ reaction is also well fitted by considering the combined effects of the target electron screening and the narrow resonance at E_p = 10 keV ($5/2^{+}$ level at E_x = 8.70 MeV in ^{11}C) assuming a constructive interference between the latter level and the level of the same spin and parity values at 9.67 MeV excitation. The S(E) factor values extrapolated on the basis of the present analysis of the two reactions lead to stellar reaction rate values consistent with the most recent calculations. The extracted values of the involved nuclear level parameters in (^{11}C, ^{12}C), the derived U_e electron screening potential values as well as the stellar reaction rate values are discussed in comparison to those reported in the literature.