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P3.089 The coherent weak flavour charge of ordinary matter for neutrino-exchange forces

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We study the long-range force arising between two aggregates of ordinary matter due to a neutrino-pair exchange, in the limit of zero neutrino mass. Even if matter is neutral of electric charge, it is charged for this weak force. The interaction is described in terms of a coherent charge, which we call the weak flavour charge of aggregated matter. For each one of the interacting aggregates, this charge depends on the neutrino flavour as $Q_W^{v_e} = 2Z - N$, $Q_W^{v_\mu} = Q_W^{v_\tau} = -N$, where Z is the atomic number and N the neutron number. $Q_W^{v_e}$ depends explicitly on Z because of the charged current contribution to $\nu_e e$ elastic scattering, while the N term in the three charges comes from the universal neutral current contribution. The effective potential describing this force is repulsive and decreases as r^{-5} . Due to its specific behaviour on (Z, N) and r , this interactions is distinguishable from both gravitation and residual electromagnetic forces. As neutrinos are massive and mixed, this potential is valid for $r \lesssim 1/m_\nu$.