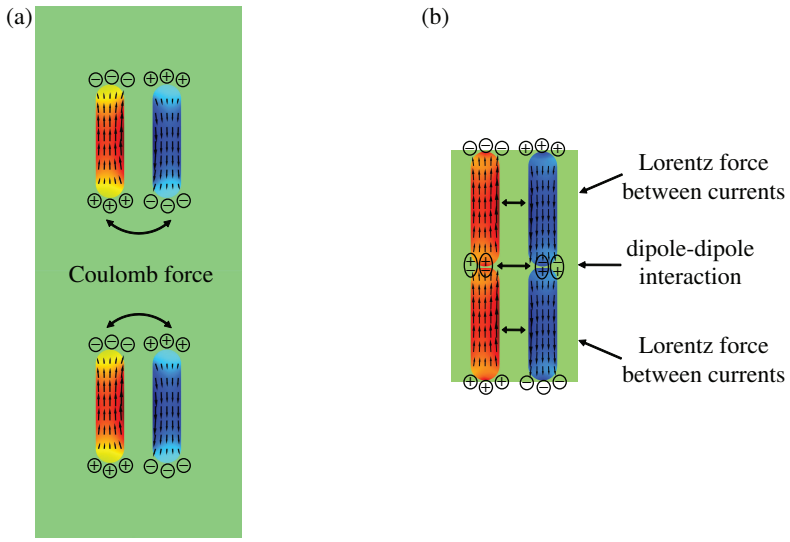

Fig. 11. Charge and current distribution in the nanowire pair metamaterial. (a) If the height of the unit cell is substantially larger than the length of the nanowires, the force at the magnetic dipole resonance frequency has the nature of a Coulomb force between the charges at the ends of the wires and is attractive for the magnetic dipole resonance. (b) If the height of the unit cell is only slightly larger than the length of the nanowires, the force at the magnetic dipole resonance frequency has the nature of an electric dipole-dipole interaction; the repulsive Lorentz force between the currents flowing in opposite directions can now be of comparable size or even dominate the optical force.

unit cells becomes smaller than the distance between nanowires in the same unit cell, the optical force changes from a Coulomb force between point charges into a much weaker dipole-dipole interaction. (ii) As the force between the charges at the ends of the nanowires becomes smaller, the Lorentz force between the currents in the nanowires will finally start to dominate, which explains the reversion from an attractive to a repulsive force.

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